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(54) Process and machine for wrapping products with stretchable film

Verfahren und Vorrichtung zum Umhüllen von Gegenständen mit streckbarer Folie und Hülle

Procédé et dispositif pour envelopper des produits, avec une feuille extensible

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Description

The present invention relates to a process and machine for wrapping products with stretchable film.

There are known processes and machines which carry out the said wrapping operation automatically, without subjecting the stretchable film to a previous phase of pre-stretching. A machine of this type is illustrated, for example, in document GB-A-1 297 849.

From document US-A-3 967 433 there is known a process and machine which subject the stretchable film to pre-stretching before forcing the product against it, so as to take maximum advantage of the characteristics of stretchability of the film used. This machine and process permit the wrapping of products having dimensions which vary over a wide range, without changing the width of the film used and also permit the reduction of the differential tensions in the film in contact with the products, ensuring greater strength of the film and more delicate treatment of the packaged product. A similar machine is disclosed in Italian Patent Application No. GE91A000024.

Document EP-A-0 092 759 discloses a film wrapping machine of this type, in which sensing means are provided for sensing the width, length and height of the product to be packaged which sensing means select the length of the wrapping film drawn from a supply source.

According to the mentioned prior art documents, it is therefore known a process and machine for wrapping products or articles having different dimensions using a stretchable film comprising the steps of:

- ascertaining length, width and height dimensions of an article to be wrapped,
- feeding a longitudinal segment of the stretchable film to a wrapping station, including the step of determining a length dimension of the longitudinal segment to be fed to the wrapping station which is proportionate to at least the length dimension of the article determined in the said ascertaining step,
- pre-stretching at least transversely the said segment of film and lifting the article to be wrapped against the said pre-stretched portion of film, and
- folding the film about the article so that the flaps of the film are extended under tension onto the bottom of the said article.

The process and machine according to the present invention relate to a process and machine of the type above disclosed, which is characterized by the fact that the said pre-stretching step comprises the transverse pre-stretching of a selected intermediate portion of the longitudinal segment of the stretchable film, and includes the steps of:

- a) selecting a desired length dimension of the intermediate portion to be stretched which is proportionate to the length dimension of the longitudinal segment determined by the said determining step

such that the desired length dimension of the intermediate portion is also proportionate to the length dimension of the article,

- b) providing, on each lateral side of the longitudinal segment, a variable length clamping means for clamping different lengths of intermediate portions in order to clamp at each lateral side the desired length dimension of the intermediate portion,
- c) actuating the variable length clamping means at each lateral side so that the length of the clamping means substantially equals the selected length dimension of the intermediate portion, and
- d) moving the actuated clamping means transversely away from one another to pre-stretch the intermediate portion.

Briefly, the process and machine according to the invention operate in the following manner.

It should be stated initially that the terms "front" and "rear" used below refer to the direction of advance of the products towards the discharge area of the machine. The terms "placed under" and "superimposed" used for the flaps of film extended on the bottom of the product refer to the effective reciprocal position of these flaps with respect to the vertical, so that one flap is, for example, considered to be placed under another when it is located beneath it.

The term "segment" is used to refer to a determined length of the film which may (in accordance with the preferred embodiment) be initially connected to a supply of the film and is only subsequently separated from the supply of the film after processing in the machine, or which may be initially discrete and is subsequently processed in the machine.

The term "portion" is used to refer to a longitudinal length of the segment which is transversely pre-stretched in the machine.

A segment of the film, having a length proportionate to the dimension of the product which is aligned longitudinally with the film, is extended horizontally under the lifter which carries the product to be wrapped. The film is extended longitudinally but is not stretched. The leading end of the segment of the film is held by a rear clamp associated with the underlying movable rear folder of the machine, while the other end of the segment of the film, still joined to the supply reel, is controlled by a comb-like dispenser fixed under the front folder, which is also fixed, of the machine, in relation to which folder the product to be wrapped has a fixed reference point in the transfer to the lifter.

The travel of the rear folder with the rear film holding clamp, and consequently the distance between this mechanism and the front fixed folder, varies according to the dimensions of the product to be wrapped.

Each of the clamps which grip the film laterally consists of a plurality of adjacent clamps, designed to be able to grip portions of film of different lengths which are directly proportionate to the dimensions of the product to be wrapped. The smaller the product, the shorter will

be the length of the portion of film gripped by the side clamps.

A first phase of the wrapping cycle consists in the gripping, by the said clamps, of the sides of a portion of film whose length is proportionate to the dimensions of the product to be wrapped. This portion of film is then pre-stretched transversely according to the dimensions of the product to be wrapped. If an appropriate and/or suitably treated film is used, the prestretching may be of the order of 100-200% or more of the width of the film present at the wrapping point. When these pre-stretching values are used, the pre-stretched side flaps are joined to the original film by corner areas characterized by a small radius of curvature, a condition which prevents subsequent excessive and random accumulation of film in the corner areas of the product carrying tray to be wrapped.

While the pre-stretching is being carried out, the longitudinal tension of the film is automatically diminished by a suitable approach of the rear clamp and by a suitable drawing of film from the fixed dispenser.

In the next phase, the product is lifted against the transversely pre-stretched film, while the side clamps approach each other with a self-centring movement and with a displacement which is a function of the dimensions of the product and of its characteristics of deformability under compression, in order to reconcile the following requirements: keeping the film stretched, while preventing the development of localized excessive tensions in it which might tear it and preventing the crushing of the wrapped product. These conditions are also made possible by the fact that, while the product is lifted against the film, the latter is free to react longitudinally since it is still joined to the feed reel through the dispenser, and since the rear clamp also moves through a correct distance towards the product.

The side clamps are then made to approach each other to the maximum extent, and are opened at the correct time to extend the side flaps of the wrapping film under the product. In this phase the product is kept pushed downwards by a presser above it, and the side clamps cause the knocking down of the oscillating supports of the lifter which then descends.

At this point, the rear folder comes into action and extends under the side flaps of the wrapping and under the product carrying tray, the portion of the rear flap of film still being held by the rear clamp. On the carriage of the rear folder there is also mounted the pusher which, coming into contact with the product carrying tray, pushes it towards the fixed front folder.

When the product carrying tray is sufficiently supported by the front folder, before the rear folder reaches the end of its active travel, the side clamps move away from each other and beyond the transverse extent of the wrapping film.

While the product carrying tray is pushed on to the front folder, a correct quantity of film is drawn from the underlying fixed dispenser and is extended under the side flaps of the wrapping and under the product carry-

ing tray. Before the rear folder reaches the front folder, the rear clamp is made to open and is lowered in order to interact with the dispenser, while the rear folder accompanies the rear flap on to the front folder which extends on to the bottom of the product the said front flap, drawn with the correct tension from the dispenser and applied progressively to the whole length of the product. At the correct time, the front flap is cut by a means operating immediately downstream of the dispenser, after which the new end of the film is gripped by the rear clamp which then withdraws, together with the rear folder and pusher, extending at the wrapping point a portion of film of length proportionate to the dimensions of the next product to be wrapped. The previously wrapped product is transferred from the front folder to the welding conveyor which then removes it.

With the process described, there is disposed on the bottom of the product carrying tray, over its whole length, a flap of substantially unstretched film, correctly superimposed on the other flaps which have also undergone little stretching, so that the assembly of superimposed flaps of the wrapping can react uniformly and in the most favourable way to the fixing welding and can provide a sealed closure of the said wrapping.

Further characteristics of the invention, and the advantages derived therefrom, will be clearly understood from the following description of a preferred embodiment of the invention, illustrated solely by way of example and without restriction in the figures on the fifteen attached sheets of drawings, in which

Fig. 1 is a side view of the machine in section along the median axis;

Fig. 2 is a partial plan view from above of the machine drawn in two different operating conditions;

Fig. 3 is a plan view from above and partial section of the product feed assembly, the lifter assembly, the rear folder, pusher, and rear clamp assembly, and the front folder and welding conveyor assembly;

Fig. 4 shows details of the machine in section along the line IV-IV in Figure 1, and drawn with the side clamps partly in the maximum pre-stretching position and partly in the opposite position of maximum approach to the product to be wrapped;

Fig. 5 shows further details of the machine drawn according to the section line V-V in Figure 1;

Figs. 6a and 6b show an enlargement, from the side and in partial section, of one of the side clamps in the closed and open positions respectively;

Fig. 7 is a side view of the principal parts of the machine, at the end of one operating cycle and at the start of the next cycle;

Fig. 8 is a transverse view of the machine in the condition shown in Fig. 7;

Figs. 9 and 10 are transverse views of the machine, with the side clamps in the phase of gripping the film and in that of transverse pre-stretching of the

film;

Fig. 11 is a plan view from above of the machine during the phase of transverse pre-stretching of the wrapping film;

Figs. 12 and 13 are transverse views of the machine during the phase of lifting of the product against the pre-stretched film and in the subsequent phase of folding of the side flaps of the wrapping film on to the bottom of the said product;

Fig. 14 is a side view of the machine during the operation of the rear folder, pusher, and rear clamp assembly;

Figs. 15, 16 and 17 show the machine from the side, with parts enlarged, and during subsequent and concluding phases of the product wrapping cycle;

Fig. 18 shows the machine from the side in the return phase of the pusher, rear folder, and rear clamp assembly, for the preparation of the portion of film for the subsequent wrapping cycle;

Fig. 19 is a plan view from below of the wrapped product;

Figs. 20 and 21 show the wrapped product in Figure 19 in section along the line XX-XX and XXI-XXI respectively.

In Figures 1, 3 and 4, the reference 1 indicates the horizontal belt conveyor, with its motor 2, which feeds the products to be wrapped P to the mid-line 4 of the lifter 3 and centres them. The products P are introduced in single file and resting on the right-hand side 101 of the conveyor, where suitable presence sensors (not illustrated) may be provided. The products P are preferably orientated on the conveyor 1 with their greatest dimension lying in the transverse direction, but may be orientated differently, even randomly, owing to the machine's capability of adapting itself automatically to operation on products of different dimensions. The movement of the product on the conveyor 1 is controlled by safety devices (not illustrated) which allow one product to pass at a time, only when the lifter is in the lower position, and which automatically stop the machine when a product is not correctly disposed or has dimensions not compatible with the operating capabilities of the machine.

During the movement on the conveyor 1, the products P are scanned by at least two sets of banks 5-6 of optoelectronic sensors, which are disposed transversely both above and below the path of the product, and which, in combination with an electronic processor 7, measure the three dimensions of the product, namely the width, the height and the length (s), the last of these being deduced, given the constant value of the speed (v) of advance of the product by the conveyor 1, from the equation ($s = v \times t$), (t) being the time during which at least one of the sensors of either of the said banks 5-6 is shaded.

With its output 107 the computer 7 controls the electric motors of the driving units of the various operat-

ing mechanisms of the machine. The same computer can control the driving units of some operating mechanisms, not only with a path variable according to the dimensions and characteristics of the product to be wrapped, but also with any acceleration and deceleration which may be needed. The reference 207 indicates an optional input terminal to supply to the computer 7 any necessary variables relating to the characteristics of the product to be wrapped and/or to any characteristics of the film used.

Figures 1 and 3 show that the conveyor 1 terminates with a comb configuration, so that the parallel brackets 8 of the lifter 3 can move within it, these brackets being fixed to and projecting from the tubular beam 9 which is external to the said conveyor 1 and is in turn fixed by one end to the vertical guiding and moving means 10, which may for example be of the type with a female thread and endless screw, the latter being driven by an electronically controlled electric motor 110 connected to the computer 7. The other end of the beam 9 is provided with a roller 11 which runs in a fixed vertical guide 12 (Fig. 3). Hinged to the brackets 8 at 13, horizontally and transversely with respect to the longitudinal axis of the conveyor 1, there are oscillating supports 14, normally kept in the vertical position by elastic means 15. With the tops of these supports, the lifter 3 is initially disposed below the upper run of the conveyor 1 so that it does not interfere with the incoming product (Fig. 1). After being centred on the mid-line 4 of the lifter 3, the product P is lifted and introduced into the wrapping point of the machine, as stated previously.

If the product is of small dimensions and does not cover the supports of one or more of the final three brackets 8 disposed in the furthest projecting part of the tubular beam 9, provision is made to neutralize these brackets automatically during the raising of the lifter, to prevent interference with the rear folder assembly located above, whose rest position varies as a function of the dimensions of the product (see below). In order to achieve this object, the final three brackets 8 are mounted rotatably on the tubular beam 9 (Fig. 4) and extend beyond it by portions 108 on each of which is pivoted at 16 a pawl 17 which, by an elastic means 18, is caused to interact at one end with the step 19 in a cam 20 fixed to the beam 9 next to each bracket 8. The other free end of the pawl 17, during the raising of the lifter, can interact with a horizontal rod 21 whose position is dependent on that of the rear folder. As a result of this interaction, the pawl 17 is disengaged from the cam 20, as shown in Figure 4 by the broken line, and the bracket 8 in question swings downwards by gravity. The forked end of the bracket 8 which has swung on the tubular beam 9 comes to bear on the inner profile 120 of the corresponding cam 20, and the said bracket is disposed in an inclined position, such that the corresponding oscillating supports 14 do not interfere with the rear folder assembly located above (see below).

In the subsequent phase of the return of the lifter to the lower position for the start of the cycle, the brackets

8 which were previously neutralized, interact with a stop 22 which brings them back to the original horizontal position, with the pawl 17 returning to interact with the step 19 of the cam 20.

The horizontal rod 21 which causes the neutralization, if any, of the final brackets of the lifter 3 is parallel to the longitudinal axis of the machine, slides axially in a fixed guide 23, tends to move to the position of greatest extension under the action of a spring 24, and is connected by its rear end, with the interposition of a link 125, to a lever 25 which is hinged at 225 to the frame of the machine and which has its upper end disposed on the path of displacement of a stop 26 integral with the carriage of the rear folder.

The stretchable film F, for wrapping the product P, is drawn from a reel B disposed below the discharge area of the machine, supported, for example, rotatably about its own axis by a pair of parallel free-running rollers 27, and the said film F is taken around a pulley 28 and then between a pair of parallel rollers 29, at least one of which is rubber-covered and has its rotation controlled by friction means (not illustrated) regulated by the computer 7 (Fig. 4), the whole in such a way that when the film is pulled as it leaves the rollers 29 (Fig. 1) it remains longitudinally extended but substantially without longitudinal stretching.

On leaving the rollers 29 the film slides in a comb-like dispenser 30 parallel to the said rollers and supported by the frame of the machine, below the front folder 37. In particular (Figs. 1-18), the comb 30 is formed by an upper part 130 which is supported, together with the upper part of the rollers 29, by a structure 31 pivoted at 32 on the machine frame. When this structure is temporarily lifted, overcoming the action of suitable opposing means which are not illustrated, the leading end of the film can easily be inserted between the components 29 and 30. The surfaces of the dispenser 30 in contact with the film are suitably covered with material on which the film can slide easily.

It should be understood that the means described above for feeding the film to the dispenser 30 are described purely for guidance and may be considerably modified or replaced by others with similar functions.

On leaving the comb-like dispenser 30, the film is taken around a small roller 33 parallel to the said dispenser and supported at its ends by a pair of parallel right-angled levers 34 bent downwards and pivoted at 35 on the shoulders of the support 36 on which the lower fixed part of the comb 30 is mounted or formed. Elastic means 36 push the levers 34 upwards, against fixed stops, so that the roller 33 is raised and is at a short distance from the front folder 37. During the operating cycle of the machine, the roller 33 is lowered from the position of interaction of the said levers 34 with blocks which are carried by the carriage of the rear folder and of which more will be said subsequently.

The front folder 37 (Figs. 1-3) is formed by a plurality of horizontal coplanar rollers, parallel to each other and to the aforesaid underlying rollers 29, and having a

width suitably greater than that of the wrapping film. The rollers of the folder 37 are coplanar with the upper run of the next welding conveyor 38 to which they are connected by means of any suitable transmission system driven by the motor 39 (Fig. 3). The structure carrying the front folder and the conveyor 38 is fixed to the frame of the machine so that it can be lifted to allow access to the parts 29 and 30 when the leading end of the film unwound from a new reel has to be inserted between them, the whole being done in a way evident to experts in the art.

Between the rollers of the front folder 37 and immediately downstream of the dispenser 30 there is provided a parallel fixed bar 40 having a rounded upper profile and a longitudinal channel 41 (Fig. 16) which is open downwards. Under this bar and parallel to it there is provided a blade 42 with a serrated profile facing upwards, connected to means which can be caused to bring it from a lower rest position to an upper operating position, with partial insertion into the channel 41 which acts as a counter-blade. The blade 42, designed to cut the film transversely as it leaves the dispenser 30, may for example be carried by a mechanism in the form of a hinged parallelogram 43, one of whose sides 143 is vertical and fixed to the machine frame, while one of the longer sides 243 is in the form of a right-angled lever and is connected by a link 44 to a raising electromagnet 45 and to a counteracting lowering spring 46 (Fig. 4). It is to be understood that other suitable known means may be provided for the transverse cutting of the film.

In Figures 1, 3, 4 and 18 it can be seen that a drive unit 47, similar to the unit 10 of the lifter, is provided on the upper part of the machine, laterally with respect to the wrapping station and parallel to the longitudinal axis of the machine, the motor 147 of which drive unit is controlled by the computer 7 and the movable components of which are connected to the end of a flat horizontal carriage 48 which is parallel to the rollers of the front folder 37 and provided on the other end with rollers 49 which run in a U-shaped guide 50 parallel to the said drive unit 47 and fixed to the machine frame. The carriage 48 is provided with a recess 51 on the side facing the front folder and in this recess there projects a horizontal plate 52, with a smooth surface and with fully rounded edges, fixed to the underside of the said carriage and forming the rear folder of the wrapping film. At the end of its operating travel, the rear folder 52 is designed to run above the rollers of the front folder 37, at a short distance from these (see below).

Pairs of blocks 53-54, parallel to the drive unit 47, with wedge-shaped and downward converging ends, made of material with a low coefficient of friction, for example a suitable plastic material, are fixed on the undersides of the portions of the carriage 48 outside the area of the folder 52. One pair of these blocks, namely the inner pair 53, is aligned with the levers 34 of the oscillating roller 33 mentioned previously, to interact with the said levers and cause the lowering of the said roller. The blocks 53-54 operate on the side clamps for

gripping the wrapping film, in the way described below.

The pusher 55, which pushes the product carrying tray towards the front folder 37, is fixed on the carriage 48. The pusher 55 is disposed behind the front edge of the recess 51.

A pair of supports 56 are fixed to the underside of the rear median part of the carriage 48 and hold and allow to rotate the end of a shaft 57 which is parallel to the rear folder, which passes rotatably through a block 53 and has one end reaching one side of the machine and carrying on this end a fixed lever 58 orientated upwards and provided with a lateral appendage 59 parallel to the shaft. On the portion of the shaft 57 lying between the supports 56 there is rotatably mounted the intermediate part of a fork 60 having its prongs pointing towards the front folder and supporting with these the intermediate part of the upper flat jaw 161 of the rear clamp 61 for retaining the leading end of the wrapping film (see below). On the furthest projecting part of the supports 56 there is rotatably mounted the end of a shaft 62 which is parallel to the rear folder and whose other end, near one side of the machine, is rotatably supported by a block 54 and carries a fixed lever 63 pointing upwards and backwards, with the upper end suitably rounded and connected to a tension spring 64 which tends to pull it towards the front edge of the machine. On the portion of shaft 62 lying between the supports 56 there is keyed an eccentric 65 (Fig. 18) which can interact with the transverse part of the fork 60 with profiles 165 and 265 of different eccentricity. When the lever 63 is free, the eccentric 65 interacts with the fork 60 with its profile of greater eccentricity 265 and as a result of this interaction the upper jaw 161 of the clamp 61 is raised and bears on the underside of the rear folder 52 from which it projects with a roller 66 which is parallel to the front edge of the said folder and is supported so that it can freely rotate by the ends by supports 67 fixed with their flat appendages in upper recesses of the jaw 161. On the portion of shaft 57 lying between the prongs of the fork 60 there is fixed, by its end in the form of an elastic clip, an arm 68 on whose opposite end is fixed the intermediate part of the lower jaw 261 of the clamp 61, which is characterized by a comb-like form complementary to that of the dispenser 30 and which has its upper part covered with a material suitable for retaining the leading end of the film, for example with rubber inserts. Under the rear end of the fork 60 there is fixed a leaf spring 69 which interacts with the arm 68 so as to keep the clamp 61 normally closed, with the lower jaw 261 bearing on the upper jaw 161. In Figure 3 it will be seen that the shaft 57 is acted on by a miniature spring 70 (Fig. 3) which interacts with the carriage 48 and which tends to press the clamp 61 upwards with a suitable force (see below).

In the active operating travel of the rear folder 52, as shown in Figures 1, 3, 4 and 15, the appendage 59 of the lever 58 is made to interact with a first inclined and descending profile 171 of a cam 71 held by an upper support 72 so that it can swing only towards the interior

of the machine about a pivot 73 parallel to the longitudinal axis of the machine, in opposition to a leaf spring 74 which tends to keep the said cam in a vertical position. As a result of the interaction of the lever 58-59 with the cam 71, the lower jaw 261 of the clamp 61 is opened so that the clamp releases the rear flap of the wrapping film. When the clamp 61 has opened, the lever 63 is made to begin interacting with a fixed cam 75 which makes this lever swing backwards and which causes the profile of lesser eccentricity 165 of the eccentric 65 to interact with the fork 60, with a consequent downward swing of the clamp 61, as shown in Figure 16. The upper jaw 161 of the clamp 61 is disposed at such a height that it can be inserted above the dispenser 30 and parallel to the latter. In Figure 16 it can be seen that in the subsequent interaction of the lever 58-59 with the inclined and descending profile 271 of the cam 71, the lower jaw 261 of the clamp 61 is opened in opposition to the action of the spring 69 and is positioned at a height such that the teeth of this jaw can be inserted into the apertures of the lower part 230 of the dispenser 30, under the film held by this dispenser. At the end of the active travel of the rear folder assembly, the said lever 58-59 is made to interact with a raised step 371 of the profile of the cam 71, with a consequent raising of the said lever and a corresponding raising and closing of the lower jaw 261 against the upper jaw 161 of the rear clamp 61 which in this way grips the leading end of the film present in the dispenser 30. In the subsequent phase of withdrawal of the rear folder assembly, the lever 58-59 interacts with the transversely inclined edge of the step 371 of the cam 71, which is neutralized by swinging towards the interior of the machine, so that the position of the said lever is not changed and the rear clamp 61 remains closed. When the lever 58-59 leaves the cam 71, the latter, under the action of the return spring 74, returns to the active vertical position for the next cycle.

The miniature spring 70 is capable of partially compensating for the weight of the rear clamp, to simplify the action of the eccentric 65. When the lever 63 leaves the cam 75 and the eccentric interacts with the fork 60 with the profile 265 of greater eccentricity, the rear clamp 61 remains closed and returns to the high position, bearing on the underside of the rear folder 52 (Fig. 18).

In Figures 4 and 14 it can be seen that at the product wrapping point, above the imaginary horizontal plane on which the front fixed folder and the rear movable folder operate, there is provided a presser 76, substantially of a known type, for example with belts covered with or made of a yielding material, which acts on the product in the wrapping phase to prevent unwanted movements thereof. The presser 76 is such that it does not interact with the active parts of the pusher 55 and is connected to the machine frame by means of a hinged parallelogram joint 77, conveniently damped, which gives this component a constant horizontal position and an adequate degree of freedom on

the vertical.

With reference to Figures 1, 2, 4, 5, 6a and 6b, the system of side clamps and folders 78-178 will now be described. This system is moved in a self-centring way by a drive unit 79 which is parallel to the conveyor 1 and which differs from those previously described in that it is provided with two movable mechanisms inside a single guide body, driven by corresponding endless screws, driven by corresponding motors 179-279 controlled by the computer 7.

Since the two side clamp and folder assemblies are identical, only one of them will now be described, for the sake of simplicity. One of the carriages of the drive unit 79 has fixed to it in a projecting and orthogonal configuration a flat horizontal carriage 80, disposed on edge and provided at its other end with rolling means 81 which bear on and run in a fixed guide 82 parallel to the said drive unit. On the inner side of each carriage 80, facing the product wrapping point, there are located perpendicularly the identical clamps 78-178, disposed side by side and each comprising:

- a cam 83 fixed sideways on the inner side of the said carriage 80 and having its working profile indicated by 183;
- a lower jaw 84 with its top covered with a rubber insert 184 and terminating in a forked shape which encloses the said cam to which it is pivoted at 85;
- an upper jaw 86 provided with descending lateral strips 186 pivoted at 87 to the said lower jaw and supporting and allowing to rotate, below the lower jaw, a grooved roller 88 which interacts with the profile 183 of the said cam 83. The axle 188 of the roller 88 is connected to a pair of springs 89 which pass through holes 90 formed in the carriage 80 and are connected to fixing pins 91 integral with the said carriage.

The action of the springs 89 and the form of the profile 183 of the cam 83 tend to keep the lower jaw permanently pressed upwards and bearing on the upper jaw which is disposed horizontally. The clamp is therefore normally closed, and the upper jaw is horizontal, as shown in Figure 6a.

If a downward force is applied to the upper jaw 86, as shown in Figure 6b, the jaw is lowered and remains horizontal for the interaction of the roller 88 with the profile 183 of the cam 83. The upper jaw approaches the pivot of the lower jaw, whose working end is withdrawn proportionally from the working end of the upper jaw, and the clamp is opened. In this phase, the profile 183 of the cam 83 is made to be such that when the clamp is open the roller 88 is pressed upwards with a small force, while the greater part of the force exerted by the springs 89 is discharged perpendicularly on the profile of the said cam, the whole in such a way that the clamp can be kept open by a small pressure.

When the clamps 78-178 are in the closed position as shown in Figure 6a, they are disposed so that they

5 are coplanar, and their upper jaws 86 are in positions at heights such that the wedge-shaped blocks 53-54 of the carriage of the rear folder assembly lie above them when this assembly is driven in its path of approach to the front folder (Fig. 19).

In Figures 1, 2, 4, 5, 6a and 6b it can be seen that the pivot axle 85 of the lower jaws of each row of clamps 78-178 is formed by a common shaft which has perpendicularly mounted, on the end nearer the drive unit 79, a downward pointing lever 92 provided at its end with a grooved roller 93.

10 15 20 25 30 35 The shaft 85 turns freely with respect to the clamps and has, next to each clamp, a transversely mounted finger 94 below which is transversely disposed a corresponding pin 95 fixed to and projecting from one side of the lower jaw of each clamp. This solution permits the simultaneous control of the opening of each row of clamps with the rotation of the shaft 85 and also permits the selective opening of the clamps of each row when the lower wedge-shaped blocks of the carriage of the rear folder assembly passes over them, as stated above.

Above the said rollers 93 and along their path of travel there is provided a bar 96 parallel to the drive unit 79 and having in its intermediate part a vertical support 196, pointing downwards and connected to a hinged parallelogram structure 97 whose vertical side 197 is fixed to the machine frame. The side 297 of the parallelogram 97 is connected to a female thread 98 which interacts with a vertical screw 198 supported rotatably by fixed end supports and driven by an electric motor 99 connected to the computer 7, by means of which the said bar 96 may be raised and lowered for the controlled opening and closing of the clamps 78-178 (see below).

The machine as described operates in the following way.

40 45 50 55 The film F which is used is preferably characterized by high stretchability at least in the transverse direction, as specified in greater detail previously, and is preferably characterized in that its width is substantially equal or at least proportional to that of the products which the machine can wrap.

At the start of each operating cycle (Fig. 7), a segment of film F is held extended at the wrapping point, by the oscillating roller 33 in the high position and by the closed rear clamp 61 which, with the rear folder and the pusher, are separated from the dispenser 30 by a distance proportionate to the dimensions of the product to be wrapped, these dimensions being measured by the batteries of sensors 5 and 6 which have scanned the product during its feed by the conveyor 1. The length of the segment of film F extended at the wrapping point increases with the length of the product. By being supported on the said roller 33 which is substantially at the height of the clamp 61, the segment of film used for the wrapping is kept at the height where it can be gripped by the side clamps 78-178.

The side clamps 78-178 are withdrawn and are all opened by the action of the bar 96 on the rollers 93 of

the said clamps, as described with reference to Figures 5 and 6b. The clamps 78-178, which have the blocks 53-54 of the rear folder assembly lying above them, are lower than those designed to act on the film extended at the wrapping point, and therefore cannot interfere with this film, especially since they are located beyond it. In Figure 8 it can be seen that the side clamps 78-178, which are in the withdrawn position of the start or end of a cycle as indicated by the broken line, are made to approach each other as shown by the continuous line, so that they are disposed for gripping the side edges of the film F extended at the wrapping point. As illustrated in Figure 9, when the bar 96 in Figure 5 is subsequently raised, the clamps 78-178 which have been initially made to approach the film F are closed, grip the film, and because of their particular structure are raised in a coplanar configuration, while the side clamps which are under the blocks of the rear folder remain in the low position and open.

From the film gripping position illustrated in Figure 9, the side clamps are then made to undergo a self-centring movement of withdrawal from each other (Figs. 10 and 11), to transversely stretch the film used for wrapping the product, with a degree of pre-stretching directly proportional to the dimensions of the product. During this phase, the film reacts without damage to the transverse pre-stretching, even if this is of considerable extent, a convenient quantity of film being drawn from the dispenser 30, with, if necessary, a slight approach movement of the assembly carrying the clamp 61, the whole under the control of the computer 7 which enables the various components to act in all cases in accordance with the dimensions of the product to be wrapped. By using film with suitable characteristics, mono-orientated in the longitudinal direction, for example polythene film, the pre-stretching may be increased to beyond 100% or even up to and beyond 200% of the width of the film used. The greater effects of the pre-stretching will be concentrated at the centre of the pre-stretched portion, while the peripheral parts of the segment of film will be only slightly stretched. Since these peripheral parts will subsequently be extended on to the bottom of the product, they will be prepared in the best way for being welded. The side portions F1 of film stretched by the clamps (Fig. 11) will also be joined to the remaining part of the film with a small radius of curvature of the corner areas R, with a limitation of the quantity of film which is accumulated under the corner areas of the product and which normally causes considerable problems in the phase of extension on to the bottom of the product.

After the transverse pre-stretching, the product P is raised against the pre-stretched film as illustrated in Figure 12. In this phase, the side clamps 78-178 approach each other with a self-centring movement whose extent is proportionate to the dimensions and characteristics of the product to be wrapped, to keep the film extended over the product, while preventing unwanted compression of the product. During this phase (Fig. 11), the

wrapping film bears transversely on the roller 66 of the rear folder assembly and on the first roller of the front folder 37, and, when the product is raised, reacts freely in the longitudinal direction, since it can slide longitudinally with a predetermined degree of freedom through the dispenser 30 and since the said rear clamp assembly 61 can be made to approach the wrapping point to a suitable extent, again under the control of the computer 7 which operates in accordance with the dimensions and the characteristics of the product to be wrapped.

In the next phase, as illustrated in Figure 13, the side clamps 78-178, initially disposed in a closed state under the product P, are made to approach each other in a self-centring way, knocking down the oscillating supports 14 of the lifter which they encounter, and to open slightly at the correct time, with the lowering of the bar 96 in Figure 5, to leave free the side flaps F1 of the wrapping film, so that the flaps are extended neatly on to the bottom of the product.

After the operation of the side clamps, since these effectively hold the partially wrapped product which is acted on from above by the presser 76 (Fig. 14), the lifter 3 returns to the low position.

In the next phase, as illustrated in Figure 14, the rear folder assembly 52 is made to move in the direction of the front folder 37. The rear folder 52 with the roller 66 is inserted under the product and extends longitudinally on to the bottom of the product a part of the flap F2 of the film which is still retained by the clamp 61, while the rear of the product bears on the pusher 55 and moves with it. As a result of this movement, the product is progressively transferred on to the front folder 37 while a corresponding quantity of film F3 is drawn from the dispenser 30 and is extended longitudinally on to the bottom of the product, being placed progressively under the side flaps F1 of the wrapping film. The blocks 53-54 carried by the rear folder carriage progressively move above the side clamps 78-178 and lower them, preventing them from interfering with the rear clamp 61. When the product is supported sufficiently by the front folder 37, the side clamps 78-178 are withdrawn from each other by a self-centring movement and brought to the start-of-cycle position. At the correct time, as illustrated in Figure 15, the rear clamp 61 is made to open slightly by the action of the cam 71 and then to descend in order not to interfere with the front folder, while the flap F2 of film still retained by the rear folder 52 follows the product in the movement on to the front folder 37 and is superimposed on the flap of film F3 drawn from the dispenser 30, which is applied to the whole length of the bottom of the product and is cut to size at the correct time by the operation of the blade 42, as illustrated in Figure 16. From the sequence of Figures 16 and 17 it can be seen that the oscillating roller 33 has been lowered at the correct time and the rear clamp 61 has also been lowered and opened so that it can be inserted into the dispenser 30 and then be closed in the dispenser to grip the leading end of the new wrapping film, while the product which has been wrapped is finally removed by the

action of the powered rollers of the front folder 37 and the welding conveyor 38 and is temporarily stopped on this conveyor until the superimposed bottom flaps of the wrapping film have been welded. After a predetermined interval, if the machine does not discharge another wrapped product, the conveyor 38 is driven automatically to discharge the wrapped product in the cycle discussed previously.

In the subsequent movement of withdrawal of the assembly consisting of the rear clamp 61, the rear folder 52, and the pusher 55, which takes place at the correct time with the conclusion of the wrapping cycle of a product, as illustrated in Figure 18, a new segment of film F is unreeled from the dispenser 30, to an extent proportionate to the dimensions of the new product to be wrapped, while at the correct time the roller 33 rises again and the clamp 61 also rises. The extended film does not interfere with the side clamps 78-178, since these have been laterally withdrawn at the end of the preceding cycle.

The bottom side areas of the wrapping according to the invention, indicated by 200 in Figures 19, 20, and 21, are formed by two superimposed layers of film, while the side areas indicated by 300 are formed by three layers. The median area in the part 100 is formed by a single layer and in the part 200 is formed by two layers of film. The final flap F3 of film which wraps the whole length of the bottom of the product is film substantially free from stretching, so that in the subsequent transfer to the welding conveyor, the superimposed flaps of the wrapping film, all less stretched, are fixed together without risk of tearing, forming a perfectly sealed closure of the wrapping. There is no reason why the temperature of the welding conveyor 38 may not be conveniently differentiated so that it is higher in the side flaps to which the portions of wrapping 200-300 are applied and lower in the median area 100-200 of the same portion of the bottom of the wrapping.

The advantages derived from the new packaging system described herein, by comparison with known systems, may be summarized as follows:

- a considerable reduction in the consumption of wrapping film, in that the segment of film initially used has a length proportionate to the dimensions of the product, since this segment of film is pre-stretched transversely for a portion of length proportionate to the length of the product to be wrapped and since the transverse pre-stretching may reach very high values;
- the formation of an ideal wrapping with a portion of film highly stretched in the area superimposed on the product and with less stretched film on the bottom of the tray which contains the product;
- the formation of an ideal wrapping in that the flaps of the wrapping film are extended on to the bottom of the tray in a uniform way and in a predetermined and non-random order. This condition, together with that described in the preceding item, ensure

5 perfect welding of the bottom flaps of the wrapping film, without the risk of localized tears of the wrapping. This combination of conditions also ensures the formation of a wrapping with a perfectly sealed closure which is therefore suitable for containing products, such as pieces of meat, which may release liquids;

- the machine is highly simplified in respect of construction, since the rear folder 52, the pusher 55 and the clamp 61 for gripping the leading edge of the film are mounted on a single movable unit. The side clamps 78-178 also act as side folders;
- the machine does not require adjustment and may be operated without problems even by unqualified personnel, owing to the wide range of possible self-adaptation of the machine to operation on products of very different dimensions and different characteristics.

20 **Claims**

1. A process for wrapping articles (P) having different dimensions using a stretchable film comprising the steps of:

- ascertaining length, width and height dimensions of an article (P) to be wrapped,
- feeding a longitudinal segment of the stretchable film (F) to a wrapping station, including the step of determining a length dimension of the longitudinal segment to be fed to the wrapping station which is proportionate to at least the length dimension of the article determined in the said ascertaining step,
- pre-stretching at least transversely the said segment of film and lifting the article to be wrapped against the said pre-stretched portion of film,
- folding the film about the article (P) so that the flaps (F1, F2, F3) of the film are extended under tension onto the bottom of the said article,

45 **characterized by the fact that**

the said pre-stretching step comprises the transverse pre-stretching of a selected intermediate portion of the longitudinal segment of the stretchable film, and includes the steps of:

- a) selecting a desired length dimension of the intermediate portion to be stretched which is proportionate to the length dimension of the longitudinal segment determined by the said determining step such that the desired length dimension of the intermediate portion is also proportionate to the length dimension of the article,
- b) providing, on each lateral side of the longitudinal segment, a variable length clamping

means (78, 178) for clamping different lengths of intermediate portions in order to clamp at each lateral side the desired length dimension of the intermediate portion,

c) actuating the variable length clamping means (78, 178) at each lateral side so that the length of the clamping means substantially equals the selected length dimension of the intermediate portion, and

d) moving the actuated clamping means (78, 178) transversely away from one another to pre-stretch the intermediate portion.

2. A process according to claim 1, characterized by the fact that the said step of providing and actuating a variable length clamping means comprises the steps of:

- providing opposite longitudinal rows of clamps (78, 178) in the wrapping station aligned along respective lateral sides of the longitudinal segment of the stretchable film (F) fed thereto, and
- selecting a group (78) of said clamps of one row to be actuated together with a similar group (178) of the other row so that each selected clamp of one row has an opposite selected clamp of the other row, said selecting group step including the step of determining a size of the group of clamps selected which is proportionate to the length dimension determined for the article (P) and to the length dimension of the longitudinal segment.

3. A process according to claim 1, in which said moving step moves the clamping means (78, 178) so that the extent of the transverse pre-stretching is made proportionate to the desired length dimension of the intermediate portion.

4. A process according to claim 1, in which said moving step moves the clamping means (78, 178) so that the extent of the transverse pre-stretching is made proportionate to the width dimension of the article (P).

5. A process according to claim 1, in which said moving step moves the clamping means (78, 178) so that the extent of the transverse pre-stretching is made proportionate to the height dimension of the article.

6. A process according to claim 1, in which the stretchable film (F) has a width proportionate to the width dimension of the article (P) and the said pre-stretching step includes the step of concentrating maximum stretching effects on the center portion of the intermediate portion of the longitudinal segment so that the lateral sides of the remainder of the longitudinal segment which are not pre-stretched are joined to lateral sides (F1) of the pre-stretched intermediate portion by a reduced radius (R) of curvature.

5 7. A process according to claim 1, characterized by the fact that

- the said feeding step includes the step of extending the longitudinal segment of the stretchable film above the articles (P) to be wrapped in the wrapping station,
- the said pre-stretching step includes the step of reducing longitudinal tension of the longitudinal segment as a function of an extent of transverse pre-stretching,
- the said folding step includes the steps of:

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a) lifting said article against the pre-stretched intermediate portion and reducing the transverse pre-stretching and longitudinal tension of the longitudinal segment as a function of the dimensions of the article (P) to avoid unwanted tensions in the longitudinal segment and unwanted pressures on the article;

b) folding and extending under the article the lateral sides (F1) of the pre-stretched intermediate portion as side flaps thereof;

c) folding and extending under the article and under the side flaps (F1) of the pre-stretched intermediate portion a rear flap (F2) extending under the article only over a part of the length dimension of the article;

d) folding and extending under the article, under the side flaps (F1) and under the rear flap (F2), a front flap (F3) which is applied over the entire length dimension of the article.

8. A process according to claim 7 characterized by the fact of comprising the step of welding of the folded side flaps (1), rear flap (2) and front flap (3) together underneath the article (P).

9. A process according to claim 7 in which the said folding and extending of the rear flap (F2) includes the steps of holding the rear flap against the bottom side of the article, and releasing the rear flap after commencing of the folding and extending of the front flap (F3), when the rear flap (F2) is superimposed by the front flap (3).

10. A process according to claim 7, in which the front flap (F3) is formed by unstretched film.

11. A process according to claim 7, in which the said extending step includes the steps of extending the longitudinal segment longitudinally from a feed reel (B) of the stretchable film without pre-stretching the

longitudinal segment longitudinally, and holding the rear end of the extended longitudinal segment movably, and said reducing step includes the step of holding the front edge slidably under tension so that the longitudinal tension is reduced during pre-stretching as well as during said lifting step proportionally to the extent of the transverse pre-stretching of the intermediate portion.

12. A process according to claim 11, in which said folding and extending of the front flap (F3) includes the steps of cutting or weakening the trailing edge of the longitudinal segment from a remaining film of the feed reel (B) and then separating the trailing edge from the remaining film so as to provide a new leading end to be used in conjunction with a subsequent wrapping cycle.

13. A process according to claim 7 in which said folding and extending of the front flap (F3) includes the step of moving the enfolded article to a welding station (38) where the welding step is effected.

14. Machine for wrapping products with stretchable film, particularly for the application of the process described in the preceding claims, characterized in that it comprises:

- at least one reel (B) for feeding the wrapping film (F);
- means for holding, at the product wrapping point, a segment of the said film of predetermined length, extended but not substantially stretched or not necessarily stretched, these means comprising a fixed comb-like front dispenser (30) disposed next to the front fixed dispenser (37) and capable of allowing the film to slide through it only when a specified longitudinal tensile force is exceeded, so that the film remains longitudinally extended, and comprising a rear comb-like clamp (61) parallel, complementary and opposite to the said dispenser and mounted against the carriage (48), which also carries the movable rear folder (52), is operated by the computer (7) of the machine and enables this clamp to be moved towards and away from the said dispenser, with a travel proportionate to the dimensions of the product to be wrapped, initially to grip the leading end of the film, to draw the film from the said dispenser and extend a segment of film of correct length and under tension at the wrapping point, and then to reduce the tension of the film by a convenient amount in the subsequent phases of the wrapping cycle;
- means for executing the transverse pre-stretching of the film, comprising opposing clamps (78-178) connected to means of rectilinear and self-centring movement (79-179) and disposed

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to grip the longitudinal edges of the portion of film extended at the wrapping point, each of these clamps being formed by a plurality of adjacent clamps, tending to close under the action of corresponding elastic means (89) and being opened by a centralized operating system (92-93-96-99), means being provided to cause the clamps not used for gripping the film to be disposed at a lower height than the assembly comprising rear folder, rear clamp and pusher, and provision being made for the reduction of the longitudinal tension of the film, during the pre-stretching phase, with a proportional approach of the rear clamp (61) which holds the rear flap of the film and with a proportional drawing of film from the feed dispenser (30);

- a lifter (3) located at the wrapping point and capable of lifting the product to be wrapped against the film which is held by the said means and which bears at the front on the rear face of the front fixed folder (37) and at the rear on a support (66) which allows the film to slide freely, and is disposed in front of and parallel to the rear folder (52) and is preferably mounted on the upper jaw of the said movable clamp (61) so that it can subsequently leave the rear folder free in the final phase of insertion on to the front folder; the prestretching side clamps (78-178) being made to approach each other with a travel proportionate to the dimensions of the product as the product is lifted, while the longitudinal tension of the film is conveniently reduced with a suitable approach of the said rear clamp (61) and with a proportionate drawing of film from the feed dispenser (30);
- movable folding means (78-178-52) to execute the folding onto the bottom of the product initially of the side flaps (F1), formed by transverse pre-stretching of the film and held by the side clamps (78-178) which for this purpose are caused to carry out a movement of approach to each other for insertion under the product, the clamps being initially closed and with partial opening at the end of their approach travel which is proportionate to the dimensions of the product, while these clamps knock down the movable supports (14) of the lifter (3) which then returns downwards to the cycle start position, the rear folder (52) being then made to operate and extending a portion of the rear flap (F2) of the film under the product and under a portion of the said side flaps (F1), while the film remains fixed to the said rear clamp (61);
- a pusher (55) which is mounted on the carriage which also carries the rear folder (52), immediately after this folder, and which acts on the product and pushes it on to the front folder (37)

while the front flap (F3) of film is drawn under tension from the dispenser (30) and is extended on to the bottom of the product, over its whole length, being disposed progressively under the other bottom flaps (F1-F2), while the rear clamp (61) is made to open at the correct time;

- cutting means (40-41-42) which operate immediately downstream of the dispenser (30) and which cut the film transversely at the correct time to separate the final front flap (F3) of the wrapping from the new leading end of the film held by the said dispenser and which at the correct point is gripped by the rear clamp (61) associated with the rear folder and pusher assembly.

15. Machine according to Claim 14, further characterized in that it comprises:

- means (1) for feeding to the lifter the products to be wrapped;

- means (5-6-7) for measuring the dimensions of the product placed on the lifter from time to time and to determine, as a function of these dimensions, the operation of the various component parts of the machine, particularly the assembly comprising the rear folder (52), the rear clamp (61) and the pusher (55), and the assembly comprising the side clamps (78-178) for transverse pre-stretching, which also act as side folders;

- a presser (76) which acts on the product in the wrapping phase, to prevent unwanted movements thereof when the wrapping film is progressively released by the side clamps (78-178) and by the rear clamp (61) and is detached from the dispenser (30);

- means (38) which, when the product leaves the wrapping point, carry out the welding of the superimposed bottom flaps of the wrapping.

20. Machine according to Claim 14, in which the film dispenser (30) is disposed below the front folder (37), has its comb-like profile facing the rear folder (52), and is formed by a fixed lower part (230) and an upper part (130) which can be raised from the said lower part in opposition to elastic means, at least one pair of parallel and superimposed rollers (29) being provided upstream of the two parts and being associated with each of the said parts of the dispenser so that the leading edge of the film unreeled from a new reel can be easily inserted between these parts, at least one of these rollers being connected to friction means such that the film can be drawn from the dispenser only when a specified longitudinal tensile force is exceeded.

25. Machine according to Claim 14, in which the front folder (37) is formed by a plurality of free-running rollers which are parallel to each other and transverse with respect to the direction of advance of the product as it leaves the machine, these rollers being mounted on the structure which also carries the following welding conveyor (38) to which the said rollers are mechanically connected, the motion of the rollers being provided by a single motor (39).

30. Machine according to Claim 18, in which the structure which carries the forming rollers of the front folder (37) and the welding conveyor (38) is connected to the machine frame structure in such a way that it can be raised to allow access to the dispenser (30) and to the associated friction means, for insertion between these of the leading edge of the film unreeled from a new reel.

35. Machine according to Claim 14, in which there are hinged, at the sides of the lower fixed part of the dispenser (30), levers (34) extending forwards, tending to move upwards under the action of elastic means (36) and each carrying rotatably at its end a roller (33) parallel to the dispenser, disposed under the film leaving the dispenser and normally disposed in front of the front folder to keep the film extended at the wrapping point and held by its other end by the rear clamp associated with the rear folder, in a substantially horizontal position and at a height such that it can be gripped by the active members of the side clamps (78-178) for pre-stretching and folding, the said levers being made to interact with blocks (53) fixed to the carriage (48) of the rear folder assembly, when this carriage reaches the end of the operating travel, so that the said roller is disposed under the rear clamp which takes the film from the dispenser, and consequently under the next segment of film which will be drawn from the said dispenser.

40. Machine according to Claim 14, in which the rear folder (52) has a flat shape, has smooth surfaces and perfectly rounded edges, and is such that at the end of an operating cycle, when it is released by the underlying rear clamp (61) which held the rear flap of the film, it is partially introduced into the front folder (37) and is drawn out and/or released by the

45. Machine according to Claim 14, in which the front folder (37) is formed by a plurality of free-running rollers which are parallel to each other and transverse with respect to the direction of advance of the product as it leaves the machine, these rollers being mounted on the structure which also carries the following welding conveyor (38) to which the said rollers are mechanically connected, the motion of the rollers being provided by a single motor (39).

50. Machine according to Claim 18, in which the structure which carries the forming rollers of the front folder (37) and the welding conveyor (38) is connected to the machine frame structure in such a way that it can be raised to allow access to the dispenser (30) and to the associated friction means, for insertion between these of the leading edge of the film unreeled from a new reel.

55. Machine according to Claim 14, in which the front folder (37) is formed by a plurality of free-running rollers which are parallel to each other and transverse with respect to the direction of advance of the product as it leaves the machine, these rollers being mounted on the structure which also carries the following welding conveyor (38) to which the said rollers are mechanically connected, the motion of the rollers being provided by a single motor (39).

17. Machine according to Claim 14, in which the cutting means which operate downstream of the dispenser (30) comprise a grooved counter-blade (40) fixed between the rollers of the front folder (37), parallel to these, and below and opposite it a serrated blade (42) or other suitable means for the cutting or transverse weakening of the film, connected to means of guiding and of raising and lowering, for example a structure in the form of a hinged parallelogram (43) moved by an electromagnet (45) and by an elastic return means (46).

rear flap (F2) of the wrapping film which it has extended on to the bottom of the product, when this edge has been partly superimposed on the final front flap (F3).

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22. Machine according to Claim 14, in which there is fixed, on the bottom of the intermediate part of the carriage (48) carrying the rear folder and the pusher, a pair of supports (56) extending backwards and rotatably supporting the end of a shaft (57) parallel to the said carriage, on which supports there is mounted rotatably the intermediate part of a fork (60) whose prongs point forwards and carry the upper jaw (161) of the rear clamp (61) for taking the film from the dispenser (30), the rear part of the said fork being disposed to interact with an eccentric (65) keyed to the end of a shaft (62) which is supported rotatably by the said supports, parallel to the previously mentioned carriage (48), and whose other end reaches one side of the said carriage where it is supported rotatably and where it carries and is fixed to a lever (63) pointing upwards and connected to an elastic means (64) by the action of which the said eccentric tends normally to be disposed in the position of maximum eccentricity and to keep the said upper jaw of the clamp raised and bearing on the underside of the rear folder (52), provision being made so that, when the carriage described above is reaching the end of its travel of approach to the front folder, the said lever interacts with a fixed cam (75) which causes the rotation of the said eccentric into the position of lesser eccentricity (165) as a result of which the upper jaw of the clamp is lowered and is prepared for interaction with the film dispenser (30); a lever (58), disposed within the said fork (60), being fixed on the end of the shaft which forms the pivot of the upper jaw, supporting the lower jaw (261) of the clamp in question and tending to rise under the action of a leaf spring (69) fixed to the said fork (60), the said shaft (57) which forms the pivot of the clamp being made to extend to one side of the carriage which supports the clamp, where this shaft is supported rotatably and carries, fixed to it, a lever (58) pointing upwards, which, when the said carriage is reaching the end of the travel of approach to the front folder, interacts with a cam (71) which initially causes the partial lowering of the lower jaw when the upper jaw is still raised, with consequent pre-opening of the clamp which releases the rear flap of the film, after which, when the upper jaw has been lowered, the said cam causes the lowering of the lower jaw, necessary to enable the clamp to enter in the open state into the dispenser, after which the said cam ceases to act and the lower jaw is closed elastically on the upper jaw, clamping the film disposed in the dispenser, provision being made so that, in the subsequent phase of withdrawal of the carriage, when the lever operating the eccentric (65) releases the

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corresponding cam (75) and the eccentric is disposed in the position of greater eccentricity, the closed clamp is raised and is brought to bear on the underside of the rear folder.

23. Machine according to Claim 22, in which the cam (71) which causes the opening and closing of the rear clamp (61) for taking the film from the dispenser, is mounted on a support (72) with the possibility of oscillation on an axis (73) parallel to the longitudinal axis of the machine, in opposition to an elastic means (74) so that, when the said lever is released by the cam, the latter presents behind the said lever a transversely inclined face, so that in the subsequent return travel of the rear clamp (61), the said lever passes laterally across the said cam which is neutralized by swinging laterally in opposition to the said elastic means and which then, when it is released from the lever, returns to the active position for the next cycle.

24. Machine according to Claim 22, in which the shaft (57) which forms the pivot for the clamp (61) for taking the film from the dispenser is subjected to the action of a miniature spring (70) which partially compensates for the weight of the said clamp to simplify the operation of the eccentric (65) which modifies the position of the said clamp with respect to height.

25. Machine according to Claim 14, in which the side clamps (78-178) are fixed to the corresponding supporting carriages (80) connected to the self-centring movement equipment (79-179) with a structure substantially of the hinged parallelogram type, so that the upper jaw (86) always remains horizontally disposed, elastic means (89) being provided to make the jaws of each clamp tend to rise, into the closed position where the raising of the clamp is impeded by the bearing of the lower jaw (84) on the upper jaw (86).

26. Machine according to Claim 25, in which each side clamp (78-178) comprises a cam (83) fixed to and projecting from the inner side of the carriage (80) which supports each set of clamps; a lower jaw (84) hinged (85) with a forked end to the said cam; an upper jaw (86) provided with downward projecting side lugs, which are pivoted (87) to the intermediate part of the lower jaw and which carry under this pivot a free-running grooved roller (88) which interacts with the profile of the said cam, springs (89) being fixed on opposite ends of the axle (188) of this roller, and connected at their other ends to the said carriage to maintain the interaction between the roller and the cam, the whole being made in such a way that by giving the cam a particular profile it is possible to contain the pressure which the clamps, when pushed downwards and opened by

the interaction with the rear folder (52), exert on this folder.

27. Machine according to Claim 26, in which the carriage (48) of the rear folder assembly carries under it transverse wedge-shaped blocks (53-54), which during the movement of the said carriage interact with the upper jaws of the side clamps (78-178) to lower these clamps and to prevent them from interfering with the rear clamp (61) mounted on the same carriage. 5

28. Machine according to Claim 26, characterized in that the pivot (85) of the lower jaws (84) of each set of side clamps (78-178) is formed by a shaft supported rotatably by the cams (83) of the said clamps, the shaft being free with respect to the lower jaws and having transversely fixed to it fingers (94) disposed on the side of each clamp and above corresponding pins (95) fixed to and projecting from one of the prongs of the forked end of each clamp, the said shaft having an integral lever (92) which is fitted on one end at a right angle and has at one end a grooved roller (93) which runs under a rectilinear horizontal bar (96) connected to means of raising and lowering, which comprise, for example, a hinged parallelogram structure (97), a driving servo mechanism of the screw and female thread type (98-198), and an electric motor controlled by the computer (7) of the machine, so that with these means it is possible to open and close the said clamps with a flexible cycle dependent on the dimensions of the product to be wrapped. 10 15 20 25

29. Machine according to Claim 14, characterized in that the lifter (3) which introduces the product into the wrapping point is provided with oscillating supports (14) kept in the raised position by elastic means (15) and are knocked down by interference with the lower jaw of the side clamps (78-178), the first rows of these supports, closer to the rear folder (52), being mounted on brackets (8) which can swing on the tubular beam (9) which supports them, which are extended beyond this beam and each of which carries, hinged to the extension (108), a pawl (17) which has its end facing the said beam orientated upwards and is compelled by elastic means (18) to interact with a cam (20) fixed on the said beam (19) and which keeps the said bracket in the normal horizontal position; means (25-125-26) being provided which, as a function of the cycle start position of the rear folder, vary the position of a horizontal guided rod (21) which during the raising of the lifter can interact with the said pawls (17) to cause the downward swing of the brackets (8) which, with the corresponding oscillating supports, must not interfere with the said folder, any brackets (8) which are neutralized being made to interact, in the subsequent downward travel of the lifter, with 30 35 40 45 50 55

fixed stops (22) which return them to the horizontal position, with the pawl (17) which returns to interaction by a snap movement with the corresponding cam (20).

30. Machine according to Claim 14, characterized in that it comprises, laterally and below or above the product feed path to the lifter (3), banks of optoelectronic sensors (5-6) which measure the length, width and height of the product to be wrapped from time to time, and which send these data to a computer (7) to which they are supplied with any manual commands (207), and any data relative to the characteristics of the products to be wrapped and relative to the characteristics of the film used, the whole in such a way that, by processing these variables, the computer can control the withdrawal and advance of the assembly comprising the rear folder, the rear clamp and the pusher (52-61-55), as well as the approach to and withdrawal from each other of the side clamps (78-178) for transverse pre-stretching and folding of the side flaps of the film, with travels which from time to time are made proportionate to the dimensions and any characteristics of the product to be wrapped. 26

Patentansprüche

1. Verfahren zum Umhüllen von Gegenständen (P) unterschiedlicher Abmessungen unter Verwendung einer streckbaren Folie, mit folgenden Verfahrensschritten:
 - Ermitteln der Längen-, Breite- und Höhenabmessungen eines zum umhüllenden Gegenstandes (P),
 - Zuführen eines länglichen Abschnittes streckbarer Folie (F) zu einer Verpackungseinrichtung, einschließlich Bestimmen einer Längenabmessung des der Verpackungseinrichtung zuzuführenden, länglichen Abschnittes, die wenigstens der beim Ermitteln festgestellten Längenabmessung des Gegenstandes proportional ist,
 - Vor-Dehnen des Folienabschnittes wenigstens in Querrichtung und Anheben des zu umhüllenden Gegenstandes gegen das vorgedehnte Folienteilstück,
 - Falten der Folie um den Gegenstand (P) derart, daß die Folienlappen (F1, F2, F3) unter Spannung gegen die Unterseite des Gegenstandes geschlagen werden,

dadurch gekennzeichnet, daß beim Vor-Dehnen ein ausgewählter Zwischenbereich des länglichen Abschnitts streckbarer Folie vorgedehnt wird, und wobei folgende Verfahrensschritte eingeschlossen sind:

a) Auswählen einer gewünschten Längenabmessung des zu dehnenden Zwischenbereichs, die proportional zu der beim Bestimmen festgestellten Längenabmessung des länglichen Abschnittes ist, so daß die gewünschte Längenabmessung des Zwischenbereiches ebenfalls proportional zur Längenabmessung des Gegenstandes ist. 5

b) Anordnen einer Klemmvorrichtung (78, 178) veränderlicher Länge an jeder Querseite des länglichen Abschnittes zum Klemmen unterschiedlicher Längen von Zwischenbereichen, um jede Querseite über die gewünschte Länge des Zwischenbereiches zu klemmen. 10

c) Betätigen der Klemmvorrichtungen (78, 178) veränderlicher Länge an jeder Querseite, so daß die Länge der Klemmvorrichtung im wesentlichen der ausgewählten Längenabmessung des Zwischenbereiches entspricht, und 15

d) Bewegen der betätigten Klemmvorrichtungen (78, 178) quer voneinander weg zum Vor-Dehnen des Zwischenbereiches. 20

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß beim Anordnen und Betätigen der Klemmvorrichtungen veränderlicher Länge folgende Schritte vorgesehen sind: 25

- Anordnen von einander gegenüberliegenden, länglichen Reihen von Klammern (78, 178) in der Verpackungseinrichtung, die entlang den entsprechenden Querseiten des dieser zugeführten, länglichen Abschnitts streckbarer Folie (F) angeordnet sind, und 30
- Auswählen einer Gruppe (78) der Klammern einer Reihe, um gemeinsam mit einer ähnlichen Gruppe (178) der anderen Reihe betätigt zu werden, so daß jeder ausgewählten Klammer der einen Reihe eine gegenüberliegende Klammer der anderen Reihe zugeordnet ist, wobei beim Auswählen der Gruppe eine Größe der ausgewählten Klammergruppe bestimmt wird, die zu der für den Gegenstand (P) ermittelten Längenabmessung und zur Längenabmessung des länglichen Abschnittes proportional ist. 35

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß beim Bewegen die Klemmvorrichtungen (78, 178) so bewegt werden, daß das Maß der Vor-Dehnung in Querrichtung der gewünschten Längenabmessung des Zwischenbereiches angepaßt wird. 50

4. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß beim Bewegen die Klemmvorrichtungen (78, 178) so bewegt werden, daß das Maß der Vor-Dehnung in Querrichtung der Breitenab- 55

messung des Gegenstandes (P) angepaßt wird.

5. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß beim Bewegen die Klemmvorrichtungen (78, 178) so bewegt werden, daß das Maß der Vor-Dehnung in Querrichtung der Höhenabmessung des Gegenstandes (P) angepaßt wird. 5

6. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die streckbare Folie (F) eine Breite hat, die der Breitenabmessung des Gegenstandes (P) angepaßt ist und daß beim Vor-Dehnen größtmögliche Dehneffekte im Zentrum des Zwischenbereiches des länglichen Abschnittes konzentriert werden, so daß die keiner Vor-Dehnung unterworfenen Querseiten des Restes des länglichen Abschnittes mit den Querseiten (F1) des vorgedehnten Zwischenbereiches mit einem verringerten Kurvenradius (R) verbunden sind. 10

7. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß

- beim Zuführen der längliche Abschnitt streckbarer Folie oberhalb der zu umhüllenden Gegenstände (P) in der Verpackungseinrichtung ausgebreitet wird,
- beim Vor-Dehnen die Längsspannung des länglichen Abschnittes in Abhängigkeit von dem Maß der Vor-Dehnung in Querrichtung verringert wird,
- zum Falten folgende Verfahrensschritte gehören:

a) Anheben des Gegenstandes gegen den vorgedehnten Zwischenbereich und Verringern der Vordehnung in Querrichtung und der Längsspannung des länglichen Abschnittes als Funktion der Abmessungen des Gegenstandes (P), um unerwünschte Spannungen im länglichen Abschnitt und ungewollten Druck auf den Gegenstand zu vermeiden; 35

b) Falten und Ausbreiten der Querseiten (F1) des vorgedehnnten Zwischenbereiches als dessen Seitenlappen unter den Gegenstand;

c) Falten und Ausbreiten eines rückwärtigen Lappens (F2) des vorgedehnnten Zwischenbereiches unter den Gegenstand und unter die Seitenlappen (F1), derart, daß er sich unter dem Gegenstand lediglich über eine Teillänge des Gegenstandes erstreckt;

d) Falten und Ausbreiten eines Vorderlappens (F3) unter den Gegenstand, unter die Seitenlappen (F1) und unter den rückwärtigen Lappen (F2) so, daß er über die gesamte Längenabmessung des Gegen- 55

standes angeordnet ist.

8. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß die gefalteten Seitenlappen (1), der rückwärtige Lappen (2) und der Vorderlappen (3) unter dem Gegenstand (P) miteinander verschweißt werden. 5

9. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß beim Falten und Ausbreiten des rückwärtigen Lappens (F2) dieser gegen die Unterseite des Gegenstandes gehalten wird und nach Beginn des Faltens und Ausbreitens des Vorderlappens (F3) der rückwärtige Lappen (F2) freigegeben wird, wenn er von dem Vorderlappen (F3) überdeckt wird. 10 15

10. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß der Vorderlappen (F3) von ungestreckter Folie gebildet wird. 20

11. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß beim Ausbreiten der längliche Abschnitt in Längsrichtung von einer Zufuhrhaspel (B) mit streckbarer Folie ausgezogen wird, ohne den länglichen Abschnitt in Längsrichtung vorzudehnen und das rückwärtige Ende des ausgezogenen länglichen Abschnitts beweglich gehalten wird und daß beim Entspannen die Vorderkante unter Spannung verschieblich gehalten wird, so daß die Längsspannung sowohl während dem Vor-Dehnen als auch während dem Anheben proportional zu dem Maß der Vordehnung in Querrichtung des Zwischenbereiches verringert wird. 25 30 35

12. Verfahren nach Anspruch 11, dadurch gekennzeichnet, daß beim Falten und Ausbreiten des Vorderlappens (F3) die Hinterkante des länglichen Abschnitts von der restlichen Folie auf der Zufuhrhaspel (B) abgeschnitten oder geschwächtet wird und dann von der Restfolie abgetrennt wird und so eine neue Vorderkante für den nachfolgenden Umhüllungszyklus vorgesehen wird. 40

13. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß beim Falten und Ausbreiten des Vorderlappens (F3) der umhüllte Gegenstand einer Schweißstation (38) zugeführt wird, in der das Verschweißen erfolgt. 45

14. Vorrichtung zum Umhüllen von Gegenständen mit streckbarer Folie, insbesondere für die Verwendung bei dem in den vorangegangenen Ansprüchen angegebenen Verfahrens, gekennzeichnet durch: 50 55

- mindestens eine Haspel (B) zum Zuführen der Umhüllungsfolie (F);
- Mittel zum Halten eines Folienabschnittes vor-

bestimmter Länge am Umhüllungsbereich des Gegenstandes, wobei der Abschnitt ausgebreitet, aber nicht nennenswert oder notwendigerweise gestreckt ist, welche Mittel eine feststehende, kammartig ausgestaltete vordere Spendereinrichtung (30) aufweisen, die nahe dem vorderen festen Spender (37) angeordnet ist und der Folie ein Durchrutschen nur dann gestattet, wenn eine festgelegte Zugkraft in Längsrichtung überschritten wird, so daß die Folie in Längsrichtung ausgebreitet bleibt, und eine rückwärtige, kammartige Klemmvorrichtung (61) haben, die parallel, ergänzend und gegenüber dem Spender angeordnet ist und an einem Schlitten (48) befestigt ist, der gleichfalls eine rückwärtige Falteinheit (52) trägt, von dem Rechner (7) der Vorrichtung betätigt wird und der dieser Klemmvorrichtung ermöglicht, in Richtung auf und von dem Spender weg bewegt zu werden, mit einem Verfahrweg, der den Abmessungen des zu umhüllenden Gegenstandes angepaßt ist, um die Vorderkante der Folie anfänglich zu fassen, die Folie von dem Spender abzuziehen und einen Folienabschnitt korrekter Länge und unter Spannung an der Verpackungsstelle auszubreiten und dann die Spannung der Folie in den nachfolgenden Phasen des Umhüllungszyklus um einen geeigneten Betrag zu verringern;

- Mittel zum Vor-Dehnen der Folie in Querrichtung, mit einander gegenüberliegenden Klemmeinrichtungen (78, 178), die an Mitteln für eine geradlinige und selbstzentrierende Bewegung (79, 179) angeschlossen und so angeordnet sind, daß sie die Längskanten des Folienteilstücks greifen, das am Verpackungsbereich ausgebreitet ist, wobei jede der Klemmeinrichtungen von mehreren, benachbarten Klemmen gebildet ist, die unter Beaufschlagung von zugehörigen, elastischen Mitteln (89) schließen und mittels einer zentralen Betätigungsseinheit (92,-93-96-99) geöffnet werden, wobei ferner Mittel vorgesehen sind, die bewirken, daß die zum Greifen der Folie nicht verwendeten Klemmen sich in einer geringeren Höhe als die aus rückwärtiger Faltvorrichtung, rückwärtiger Klemmvorrichtung und Schieber bestehende Anordnung befinden, und wobei Vorkehrungen getroffen sind, um die Längsspannung der Folie während der Vor-Dehnphase durch angepaßte Zufuhr der rückwärtigen Klemme (61) zu verringern, die den rückwärtigen Folienlappen hält, und durch proportionales Abziehen von Folie von der Zufuhrhaspel (30);

- eine am Verpackungsbereich angeordnete Hebeeinrichtung (3), um den zu umhüllenden Gegenstand gegen die Folie anzuheben, die von den Mitteln gehalten wird und die an ihrem

vorderen Ende an der Rückseite der vorderen, feststehenden Falteinrichtung (37) und an ihrem rückwärtigen Ende an einem Halter (66) gehalten ist, der der Folie ein unbehindertes Gleiten erlaubt, und die parallel zur rückwärtigen Falteinrichtung (52) und vor dieser angeordnet ist, vorzugsweise an der oberen Klemmbacke der beweglichen Klemmeinrichtung (61), so daß sie die rückwärtige Falteinrichtung in der Schlußphase des Einföhrens in die vordere Falteinheit nachfolgend freigibt; wobei die die Vor-Dehnung bewirkenden Seitenklemmeinrichtungen (78, 178) so ausgestaltet sind, daß sie beim Anheben des Gegenstandes um einen Betrag aneinander rücken, der den Abmessungen des Gegenstandes angepaßt ist, während die Längsspannung der Folie in geeigneter Weise durch eine passende Bewegung der rückwärtigen Klemmeinrichtung (61) unter angemessenem Abziehen von Folie von dem Zuführspender (30) verringert wird;

- bewegliche Falteinrichtungen (78-178-52) zum Falten auf die Unterseite des Gegenstandes zuerst der Seitenlappen (F1), die durch Vor-Dehnen der Folie in Querrichtung gebildet und von den Seitenklemmeinrichtungen (78, 178) gehalten sind, die zu diesem Zweck zum Einföhren unter den Gegenstand sich aufeinander zu bewegen, wobei die Klemmen anfänglich geschlossen sind und sich am Ende der aufeinander zu gerichteten, den Abmessungen des Gegenstandes angepaßten Bewegung teilweise öffnen, und wobei die Klemmen die beweglichen Halter (14) der Hebeeinrichtung (3) umstoßen, die dann wieder nach unten in die Anfangsstellung des Zyklus verfährt, die rückwärtige Falteinrichtung (52) dann betätigt wird und einen Teil des rückwärtigen Lappens (F2) der Folie unter den Gegenstand und unter einen Teil der Seitenlappen (F1) legt, während die Folie an der rückwärtigen Klemmeinrichtung (61) gehalten bleibt;
- eine Schiebeeinrichtung (55) an einem Support, der gleichfalls die rückwärtige Falteinrichtung (52) trägt, unmittelbar hinter der Falteinrichtung, die auf den Gegenstand einwirkt und diesen gegen die vordere Falteinrichtung (37) schiebt, während der Vorderlappen (F3) der Folie unter Spannung von der Spendereinrichtung (30) gezogen und auf die Unterseite des Gegenstandes über dessen gesamte Länge gelegt wird, und zwar stufenweise unter die anderen Bodenlappen (F1-F2), während die rückwärtige Klemmeinrichtung (61) zur richtigen Zeit öffnet;
- Schneidmittel (40-41-42), die unmittelbar in Durchlaufrichtung hinter dem Spender (30) wirksam sind und die die Folie im gewünschten

Zeitpunkt quer schneiden, um den letzten Vorderlappen (F3) der Verpackung von der neuen Vorderkante der von der Spendereinrichtung gehaltenen Folie abzutrennen, die zum richtigen Zeitpunkt von der rückwärtigen Klemmeinrichtung (61) an der hinteren Falt- und Schiebeanordnung gegriffen wird.

15. Vorrichtung nach Anspruch 14, gekennzeichnet durch:

- Mittel (1) zum Zuführen der zu umhüllenden Gegenstände zu der Hebeeinrichtung;
- Mittel (5-6-7) zum gelegentlichen Messen der Abmessungen des auf der Hebeeinrichtung angeordneten Gegenstandes und zum Festlegen der Betriebsweise von verschiedenen Bau- teilen der Vorrichtung in Abhängigkeit dieser Abmessungen, insbesondere der die rückwärtige Falteinrichtung (52), die rückwärtige Klemmeinrichtung (61) und den Schieber (55) aufweisenden Anordnung und der die auch als Seitenfalteinrichtungen wirkenden Seitenklemmeinrichtungen (78-178) zum Vor-Dehnen in Querrichtung aufweisenden Anordnung;
- eine auf den Gegenstand beim Umhüllen wirkende Andruckeinrichtung (76), um unerwünschte Bewegungen des Gegenstandes zu vermeiden, wenn die Umhüllungsfolie von den Seitenklemmeinrichtungen (78-178) und der rückwärtigen Klemmeinrichtung (61) fortschreitend freigegeben und von dem Spender (30) abgetrennt wird;
- Mittel (38) zum Verschweißen der übereinanderliegenden Bodenlappen der Verpackung, wenn der Gegenstand den Verpackungsbe- reich verläßt.

**16. Vorrichtung nach Anspruch 14, dadurch gekenn-
zeichnet, daß die Folienspendereinrichtung (30)
unterhalb der vorderen Falteinheit (37) angeordnet
ist, ein zur rückwärtigen Falteinheit (52) weisendes,
kammartig ausgestaltetes Profil aufweist und von
einem feststehenden Unterteil (230) und einem
Oberteil (130) gebildet wird, das von dem Unterteil
gegen die Wirkung von elastischen Mitteln ange-
hoben werden kann, wobei mindestens ein Paar par-
allele, übereinander angeordnete Rollen (29) in
Durchlaufrichtung vor den beiden Teilen angeord-
net und jedem der Spenderteile so zugeordnet
sind, daß die Vorderkante der von einer neuen Has-
pel zugeführten Folie leicht zwischen diese Teile
eingeführt werden kann, wobei mindestens eine
der Rollen an Reibmittel angeschlossen ist, derart,
daß die Folie von dem Spender nur dann abgezo-
gen werden kann, wenn eine bestimmte Zugkraft in
Längsrichtung überschritten wird.**

17. Vorrichtung nach Anspruch 14, dadurch gekenn-

zeichnet, daß die in Durchlaufrichtung hinter der Spendereinrichtung (30) wirksamen Schneidmittel ein zwischen den Rollen der vorderen Falteinheit (37) und parallel zu diesen angeordnetes, mit Nuten versehenes Gegenmesser (40) und ein unterhalb von diesem und entgegengesetzt angeordnetes Sägezahnmesser (42) oder andere geeignete Mittel zum Abtrennen oder Schwächen der Folie in Querrichtung aufweisen, die an Führungsmittern und einer Anhebe- und Absenkseinrichtung angeordnet sind, beispielsweise einer Baueinheit in Form eines von einem Elektromagneten (45) und elastischen Rückführmitteln (46) beaufschlagten Gelenkparallelogramms (43). 5

18. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß die vordere Falteinheit (37) von mehreren, freilaufenden Rollen gebildet wird, die zueinander parallel und quer zur Förderrichtung des Gegenstandes beim Verlassen der Vorrichtung ausgerichtet sind, wobei die Rollen an der den nachfolgenden Schweißförderer (38) aufweisenden Baueinheit angeordnet sind, mit dem die Rollen mechanisch verbunden sind, und wobei die Bewegung der Rollen mittels einem einzigen Antrieb (39) bewirkt wird. 15

19. Vorrichtung nach Anspruch 18, dadurch gekennzeichnet, daß die die Formrollen der vorderen Falteinheit (37) und den Schweißförderer (38) aufweisende Baueinheit am Maschinenrahmen derart angeschlossen ist, daß sie angehoben werden kann, um Zugang zu der Spendereinrichtung (30) und den zugehörigen Reibmitteln zu schaffen, um zwischen diesen die Vorderkante der von einer neuen Haspel abgewickelten Folie einzuführen. 20

20. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß an den Seiten des feststehenden Unterteils der Spendereinrichtung (30) nach vorne sich erstreckende Hebel (34) angelenkt sind, die unter Wirkung von elastischen Mitteln (36) dazu neigen, sich nach oben zu bewegen und von denen jeder an seinem Ende eine zum Spender parallele Rolle (33) drehbar trägt, die unterhalb der vom Spender ablaufenden Folie liegt und normalerweise vor der vorderen Falteinheit angeordnet ist, um die Folie im Verpackungsbereich ausgebreitet zu halten und die an ihrem anderen Ende mittels der zur rückwärtigen Falteinheit gehörenden, rückwärtigen Klemmeinrichtung gehalten wird, in im wesentlichen horizontaler Lage und in einer solchen Höhe, daß sie von den wirksamen Teilen der Seitenklemmen (78-178) zum Vor-Dehnen und Strecken gegriffen werden kann, wobei die Hebel so ausgestaltet sind, daß sie mit Widerlagern (53) zusammenwirken, die am Schlitten (48) der rückwärtigen Faltanordnung zusammenwirken, wenn dieser Schlitten die Endstellung des Betriebsweges erreicht, so daß die Rolle unterhalb der rückwärtigen Klemmeinrichtung angeordnet ist, die die Folie von der Spendereinrichtung entnimmt, und dementsprechend unter dem nächsten Folienabschnitt liegt, der von der Spendereinrichtung abgezogen wird. 25

21. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß die rückwärtige Falteinrichtung (52) eine flache Gestalt hat, mit glatten Oberflächen und perfekt abgerundeten Kanten versehen ist und derart ausgestaltet ist, daß am Ende eines Betriebszykluses vor dem Öffnen der darunterliegenden, den rückwärtigen Lappen der Folie haltenden rückwärtigen Klammer (61) die Folie in die vordere Falteinrichtung (37) eingeführt und mit dem rückwärtigen Lappen (F2) der auf der Unterseite des Gegenstandes ausgebreiteten Umhüllungsfolie herausgezogen und/oder freigegeben wird, wenn diese Kante von dem letzten, vorderen Lappen (F3) teilweise überdeckt ist. 30

22. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß an der Unterseite des Zwischenteiles des die rückwärtige Falteinrichtung und den Schieber tragenden Schlittens (48) ein Paar nach hinten vorragende Träger (56) befestigt sind, die das Ende einer Achse (57) drehbar und parallel zum Schlitten halten und an denen das Zwischenstück einer Gabel (60) drehbar angeordnet ist, deren Klauen nach vorne weisen und die obere Haltebacke (161) der rückwärtigen Klemmeinrichtung (61) für die Übernahme der Folie vom Spender tragen, wobei der hintere Teil der Gabel so ausgestaltet ist, daß er mit einem Exzenter (65) zusammenwirkt, der am Ende einer Welle (62) aufgekeilt ist, die an den Trägern parallel zu dem zuvor genannten Schlitten (48) drehbar gelagert ist, und deren anderes Ende an eine Seite des Schlittens heranreicht, wo es drehbar gelagert ist und wo es mit einem Hebel (63) fest verbunden ist, der nach oben gerichtet und mit einem elastischen Mittel (64) verbunden ist, unter dessen Wirkung der Exzenter üblicherweise in einer Lage größtmöglicher Exzentrizität ausgerichtet ist und die oberen Haltebacken der Klemmeinrichtung angehoben hält, während an der Unterseite der rückwärtigen Falteinrichtung Vorkehrungen getroffen sind derart, daß wenn der oben beschriebene Schlitten die Endlage seines Fahrweges zur vorderen Falteinrichtung erreicht, der Hebel mit einem feststehenden Nocken (75) zusammenwirkt, der ein Verschwenken des Exzenter in eine Stellung geringerer Exzentrizität bewirkt, wodurch die obere Haltebacke der Klemme abgesenkt wird und für ein Zusammenwirken mit der Folienspendereinrichtung (30) vorbereitet wird; ein Hebel (58), der an der Gabel (60) angeordnet ist und am Ende der Achse angeschlagen ist, die den Schwenkpunkt für die 35

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obere Haltebacke bildet und die untere Haltebacke der fraglichen Klemme trägt und unter der Wirkung einer Blattfeder (69) nach oben gedrückt gehalten ist, die an der Gabel (60) angeordnet ist, wobei die als Schwenkpunkt der Klemme wirkende Achse (57) so ausgestaltet ist, daß sie sich bis zur einen Seite des die Klemme tragenden Schlittens erstreckt, wo die Achse drehbar gelagert ist und einen daran befestigten Hebel (58) trägt, der nach oben gerichtet ist und der bei Erreichen der Endstellung des Schlittens beim Verfahren in Richtung auf die vordere Falteinrichtung mit einem Nocken (71) zusammenwirkt, der anfänglich bewirkt, daß der untere Haltebacken teilweise abgesenkt wird, wenn der obere Haltebacken sich noch in seiner angehobenen Stellung befindet, mit einer entsprechenden Vor-Öffnungsbewegung der Klemme, die den rückwärtigen Lappen der Folie freigibt, woraufhin nach Absenken des oberen Haltebacken der Nocken das Absenken des unteren Haltebackens bewirkt, was erforderlich ist, um der Klemmvorrichtung zu ermöglichen, in offener Stellung zur Spendereinrichtung zu gelangen, woraufhin der Nocken nicht länger wirkt und der untere Haltebacken elastisch gegen den oberen Haltebacken geschlossen wird und die von der Spendereinrichtung angeordnete Folie einspannt, wobei die Anordnung so getroffen ist, daß beim nachfolgenden Zurückziehen des Schlittens, wobei der den Exzenter (65) betätigende Hebel den entsprechenden Nocken (75) freigibt und der Exzenter in einer Stellung größerer Exzentrizität angeordnet ist, die geschlossene Klemme angehoben und in Anlage an die Unterseite der rückwärtigen Falteinrichtung gebracht wird.

23. Vorrichtung nach Anspruch 22, dadurch gekennzeichnet, daß der das Öffnen und Schließen der rückwärtigen Klemmvorrichtung (61) für die Übernahme der Folie von der Spendereinrichtung bewirkende Nocken (71) an einem Träger (72) mit der Möglichkeit einer Pendelbewegung um eine Achse (73) parallel zur Längsachse der Vorrichtung gegenüber einem elastischen Mittel (74) so angeordnet ist, daß, wenn der Hebel von dem Nocken freigegeben wird, dieser hinter dem Hebel eine quer verlaufende, schräge Fläche bildet, so daß bei der nachfolgenden Rücklaufbewegung der rückwärtigen Klemmeinrichtung (61) der Hebel seitlich an dem Nocken vorbeigeht, der durch seitliches Verschwenken entgegen dem elastischen Mittel außer Kraft gesetzt ist und dann nach Freigabe von dem Hebel in seine wirksame Stellung für den nächsten Zyklus zurückkehrt.

24. Vorrichtung nach Anspruch 22, dadurch gekennzeichnet, daß die den Schwenkpunkt für die Klemmeinrichtung (61) für die Übernahme der Folie von der Spendereinrichtung bildende Welle (57)

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der Betätigung durch eine Miniaturfeder (70) unterworfen ist, die das Eigengewicht der Klemmeinrichtung teilweise kompensiert, um die Betätigung des Exzenter (65) zu vereinfachen, der die Stellung der Klemmeinrichtung hinsichtlich der Höhe verändert.

25. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß die Seitenklemmeinrichtungen (78-178) an entsprechenden Trägerschlitten (80) angeordnet sind, die an der Vorrichtung (79-179) für die selbstzentrierende Bewegung mittels eines nach Art eines Gelenkparallelogramms ausgestalteten Bauteils angeschlossen sind, so daß die obere Haltebacke (86) immer etwa horizontal ausgerichtet bleibt, und daß elastische Mittel (89) vorgesehen sind, die die Haltebacken in einer Anhebebewegung beaufschlagen und in ihre geschlossene Stellung bringen, in der die weitere Anhebebewegung durch Anlage des unteren Haltebackens (84) gegen den oberen Haltebacken (86) verhindert wird.

26. Vorrichtung nach Anspruch 25, dadurch gekennzeichnet, daß jede Seitenklemmeinrichtung (78-178) einen an dem die jeweiligen Klammernsätze aufweisenden Schlitten (80) angeordneten, von dessen Innenseite vorspringenden Nocken (83) aufweisen; ein unterer Haltebacken gelenkig (85) an einem gabelartigen Ende des Nockens angeschlossen ist; ein oberer Haltebacken (86) mit nach unten vorspringenden Seitenansätzen versehen ist, die zum Zwischenteil des unteren Haltebackens hin schwenkbar (87) sind und unterhalb dieses Schwenkpunktes eine freilaufende Nutrolle (88) tragen, die mit dem Profil des Nockens zusammenwirkt, wobei an den beiden gegenüberliegenden Enden der Achse (188) dieser Rolle Federn angreifen, die mit ihren anderen Enden an dem Schlitten angreifen, um das Zusammenwirken zwischen Rolle und Nocken sicherzustellen, wobei die gesamte Anordnung so getroffen ist, daß es durch Ausgestaltung des Nockens mit einem bestimmten Profil möglich ist, den Druck aufrecht zu halten, den die Klemmen auf die rückwärtige Falteinrichtung (52) ausüben, wenn sie nach unten gedrückt und durch Zusammenwirken mit dieser Falteinrichtung geöffnet werden.

27. Vorrichtung nach Anspruch 26, dadurch gekennzeichnet, daß der Schlitten (48) der rückwärtigen Falteinrichtung an seiner Unterseite mit keilförmigen Querblöcken (53-54) versehen ist, die bei der Bewegung des Schlittens mit den oberen Klemmebacken der Seitenklemmen (78-178) zusammenwirken, um diese Klemmen abzusenken und zu verhindern, daß sie mit der rückwärtigen Klemme (61) am selben Schlitten interferieren.

28. Vorrichtung nach Anspruch 26, dadurch gekennzeichnet, daß der Gelenkpunkt (85) der unteren Klemmbacken (84) jeder Seitenklemmenanordnung (78-178) von einer drehbar an den Nocken (83) der Klemmen angeordneten Achse gebildet wird, die bezüglich der unteren Klauen (84) frei ist und mit quer angeordneten Fingern (94) auf Seiten einer jeden Klaue und oberhalb von zugehörigen Stiften (95) versehen ist, die an einem Zacken des gabelförmigen Endes einer jeden Klemme befestigt sind und von diesem vorspringen, wobei die Welle mit einem einteiligen Hebel (92) versehen ist, der an einem Ende unter einem rechten Winkel angeordnet ist und an einem Ende mit einer Nutrolle (93) versehen ist, die unter einer geradlinigen, waagerechten Leiste (96) läuft, die sich an einer Hebe- und Senkeinrichtung befindet, die beispielsweise eine Parallelogrammanordnung (97), einen Servo-Antriebsmechanismus mit Schraube und Innengewinde (98-198) und einen vom Rechner (7) gesteuerten bzw. geregelten elektrischen Antrieb aufweist, so daß es mit dieser Anordnung möglich ist, die Klemmen in einem anpassungsfähigen Zyklus in Abhängigkeit von den Abmessungen des zu umhüllenden Gegenstandes zu öffnen und zu schließen.

29. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß die den Gegenstand in den Verpackungsbereich einführende Hebeeinrichtung (3) mit hin- und herbeweglichen Tragfüßen (14) versehen ist, die mit Hilfe elastischer Mittel (15) in ihrer angehobenen Stellung gehalten werden und durch Einwirkung der unteren Klauen der Seitenklemmen (78-178) nach unten gedrückt werden, wobei eine erste Reihe von Tragfüßen näher zur rückwärtigen Falteinrichtung (52) hin an Befestigungsarmen (8) angeordnet sind, die an dem rohrförmigen Träger (9) schwenkbar gelagert sind und die über diesen Träger vorragen und jeder an dem vorragenden Bereich (108) eine Klinke (17) tragen, deren dem Träger zugewandtes Ende nach oben gerichtet ist und von elastischen Mitteln (18) veranlaßt wird, mit einem an dem Träger (19) angeordneten Nocken (20) zusammenzuwirken und den Befestigungsarm (8) in seiner normalen, horizontalen Lage hält; und daß Mittel (25-125-26) vorgesehen sind, die die Stellung eines horizontalen Führungsträgers (21) in Abhängigkeit von der Startstellung der rückwärtigen Falteinrichtung verändern, welcher Führungsträger mit den Klinken (17) zusammenwirken kann, um ein Verschwenken der Befestigungsarme (8) nach unten zu bewirken, die mit den zugehörigen hin- und herbeweglichen Tragfüßen mit der Falteinrichtung nicht kollidieren dürfen, wobei jeder Befestigungsarm, der in eine Neutralstellung gebracht ist, bei der nachfolgenden Abwärtsbewegung der Hebeeinrichtung zum Zusammenwirken mit feststehenden Anschlagelementen (22) gebracht wird,

die sie in eine horizontale Stellung zurückbringen, mit Hilfe der Klinke (17), die durch eine Schnappbewegung mit dem zugehörigen Nocken (20) wieder zusammenwirkt.

30. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß sie seitlich unter- oder oberhalb des Gegenstandzufuhrweges zur Hebeeinrichtung (3) Reihen mit opto-elektronischen Sensoren (5-6) aufweist, die die Länge, Breite und Höhe des zu umhüllenden Gegenstandes von Zeit zu Zeit messen und die ermittelten Daten einem Rechner (7) zuleiten, wo sie mit von Hand eingegebenen Befehlen (207) und mit jedweden Daten betreffend die Eigenschaften der zu umhüllenden Gegenstände und der verwendeten Folie ergänzt werden, wobei die Anordnung so getroffen ist, daß durch Verarbeitung dieser Variablen der Rechner das Zurückziehen und Vorschieben der die rückwärtige Falteinrichtung, die rückwärtige Klemme und den Schieber (52-61-55) aufweisenden Anordnung steuern oder regeln kann, wie auch den Vorschub und das Zurückziehen der Seitenklemmen (78-178) voneinander für das Vor-Dehnen in Querrichtung und Falten der Folien-Seitenlappen, mit Verfahrwegen, die von Zeit zu Zeit an die Abmessungen und Eigenschaften des zu umhüllenden Gegenstandes angepaßt werden.

30 Revendications

1. Procédé pour envelopper des articles (P) ayant des dimensions différentes en utilisant une feuille pouvant être étirée, comprenant les étapes :

- de constatation des dimensions en longueur, largeur et hauteur d'un article (P) à envelopper,
- d'alimentation d'un segment longitudinal de la feuille pouvant être étirée (F) à un poste d'emballage, comprenant l'étape de détermination d'une dimension en longueur du segment longitudinal devant être amené au poste d'emballage qui est proportionnée à au moins la dimension en longueur de l'article déterminée lors de l'étape de constatation des dimensions,
- de préétirement au moins transversalement du segment de feuille et d'élévation de l'article à envelopper contre la partie préétirée de feuille,
- de pliage de la feuille autour de l'article (P) de sorte que les rabats (F1, F2, F3) de la feuille sont étirés sous tension sur le fond de l'article,

caractérisé par le fait que

l'étape de préétirement comprend le préétirement transversal d'une partie intermédiaire sélectionnée du segment longitudinal de la feuille pouvant être étirée, et comprend les étapes :

a) de sélection d'une dimension en longueur souhaitée de la partie intermédiaire à étirer, qui est proportionnée à la dimension en longueur du segment longitudinal déterminé par l'étape de détermination de telle sorte que la dimension en longueur souhaitée de la partie intermédiaire est aussi proportionnée à la dimension en longueur de l'article,

b) de prévision, sur chaque côté latéral du segment longitudinal, de moyens (78, 178) de serrage de longueur variable destinés à serrer des longueurs différentes de parties intermédiaires afin de serrer sur chaque côté latéral la dimension en longueur souhaitée de la partie intermédiaire,

c) d'actionnement des moyens (78, 178) de serrage de longueur variable sur chaque côté latéral de sorte que la longueur des moyens de serrage est sensiblement égale à la dimension en longueur sélectionnée de la partie intermédiaire, et

d) de déplacement des moyens (78, 178) de serrage actionnés transversalement à distance l'un de l'autre pour préétirer la partie intermédiaire.

2. Procédé selon la revendication 1, caractérisé par le fait que l'étape de fourniture et d'actionnement de moyens de serrage de longueur variable comprend les étapes :

- de prévision de rangs longitudinaux opposés de brides de serrage (78, 178) au poste d'emballage alignés le long de côtés latéraux respectifs du segment longitudinal de la feuille (F) pouvant être étirée y étant amenée, et
- de sélection d'un groupe (78) de brides de serrage d'un rang à actionner ensemble avec un groupe (178) semblable de l'autre rang de sorte que chaque bride de serrage sélectionnée d'un rang a une bride de serrage sélectionnée opposée de l'autre rang, cette étape de sélection de groupe comprenant l'étape de détermination de la taille du groupe de brides de serrage sélectionné qui est proportionnée à la dimension en longueur déterminée pour l'article (P) et à la dimension en longueur du segment longitudinal.

3. Procédé selon la revendication 1, dans lequel l'étape de déplacement déplace les moyens (78, 178) de serrage de sorte que l'étendue du préétirement transversal est proportionnée à la dimension en longueur souhaitée de la partie intermédiaire.

4. Procédé selon la revendication 1, dans lequel l'étape de déplacement déplace les moyens (78, 178) de serrage de sorte que l'étendue du préétirement transversal est proportionnée à la dimension en largeur de l'article (P).

5. Procédé selon la revendication 1, dans lequel l'étape de déplacement déplace les moyens (78, 178) de serrage de sorte que l'étendue du préétirement transversal est proportionnée à la dimension en hauteur de l'article.

6. Procédé selon la revendication 1, dans lequel la feuille (F) pouvant être étirée a une largeur proportionnée à la dimension en largeur de l'article (P) et l'étape de préétirement comprend l'étape de concentration des effets d'étirement maximal sur la partie centrale de la partie intermédiaire du segment longitudinal de sorte que les côtés latéraux du restant de segment longitudinal qui ne sont pas préétirés sont réunis aux côtés (F1) latéraux de la partie intermédiaire préétirée par un rayon (R) de courbure réduit.

7. Procédé selon la revendication 1, caractérisé par le fait que

- l'étape d'alimentation comprend l'étape d'extension du segment longitudinal de la feuille pouvant être étirée sur les articles (P) à envelopper au poste d'emballage,
- l'étape de préétirement comprend l'étape de réduction de la tension longitudinale du segment longitudinal en fonction de l'importance du préétirement transversal,
- l'étape de pliage suivante comprend les étapes :

a) d'élévation de l'article contre la partie intermédiaire préétirée et de réduction du préétirement transversal et de la tension longitudinale du segment longitudinal en fonction des dimensions de l'article (P) pour éviter des tensions intempestives dans le segment longitudinal et des pressions intempestives sur l'article

b) de pliage et d'extension sous l'article des côtés (F1) latéraux de la partie intermédiaire préétirée comme rabats latéraux de celle-ci ;

c) de pliage et d'extension sous l'article et sous les rabats (F1) latéraux de la partie intermédiaire préétirée d'un rabat (F2) arrière s'étendant sous l'article uniquement sur une partie de la dimension en longueur de l'article ;

d) de pliage et d'extension sous l'article, sous les rabats (F1) latéraux et sous le rabat (F2) arrière, d'un rabat (F3) avant qui est appliqué sur toute la dimension en longueur de l'article.

8. Procédé selon la revendication 7, caractérisé par le

fait qu'il comprend l'étape de soudage ensemble des rabats (1) latéraux pliés, du rabat (2) arrière et du rabat (3) avant sous l'article (P).

9. Procédé selon la revendication 7, dans lequel le pliage et l'extension du rabat (F2) arrière comprend les étapes de maintien du rabat arrière contre la base de l'article, et le relâchement du rabat arrière après le commencement du pliage et l'extension du rabat (F3) avant, lorsque le rabat (F2) arrière est superposé au rabat (3) avant. 5

10. Procédé selon la revendication 7, dans lequel le rabat (F3) avant est formé par une feuille non étirée. 15

11. Procédé selon la revendication 7, dans lequel l'étape d'extension comprend les étapes d'extension du segment longitudinal longitudinalement d'une bobine (B) d'alimentation de la feuille pouvant être étirée sans préétirer le segment longitudinal longitudinalement, et de maintien de façon mobile de l'extrémité arrière du segment longitudinal étendu, et l'étape de réduction comprend l'étape de maintien du bord avant de façon à pouvoir coulisser sous tension de sorte que la tension longitudinale est réduite pendant le préétirement ainsi que pendant l'étape de levage proportionnellement à l'importance du préétirement transversal de la partie intermédiaire. 20

12. Procédé selon la revendication 11, dans lequel le pliage et l'extension du rabat (F3) avant comprend les étapes de coupe ou d'affaiblissement du bord arrière du segment longitudinal d'une feuille restante de la bobine (B) d'alimentation et de séparation ensuite du bord arrière de la feuille restante afin de fournir une nouvelle extrémité d'attaque à utiliser lors d'un cycle d'emballage suivant. 25

13. Procédé selon la revendication 7, dans lequel le pliage et l'extension du rabat (F3) avant comprend l'étape de déplacement de l'article enveloppé vers un poste (38) d'emballage où est effectuée l'étape de soudage. 30

14. Machine pour envelopper des produits d'une feuille pouvant être étirée, en particulier pour l'application du procédé décrit dans les revendications précédentes, caractérisée en ce qu'elle comprend : 40

- au moins une bobine (B) d'alimentation en la feuille (F) d'emballage ;
- des moyens de maintien, au point d'emballage du produit, d'un segment de cette feuille de longueur prédéterminée, étendu mais sensiblement non étiré ou pas nécessairement étiré, ces moyens comprenant un distributeur (30) avant fixe en forme de peigne disposé de façon contiguë au distributeur (37) avant fixe et apte 45

à permettre à la feuille d'y glisser uniquement lorsqu'une force de traction longitudinale spécifiée est dépassée, de sorte que la feuille reste longitudinalement étendue, et comprenant une bride de serrage (61) arrière en forme de peigne parallèlement, en complément et de façon opposée au distributeur et montée contre le chariot (48), qui porte aussi la plieuse (52) arrière mobile, qui est actionné par l'ordinateur (7) de la machine et qui permet à cette bride de serrage d'être déplacée vers ce distributeur et d'en être éloignée, avec un parcours proportionné aux dimensions du produit à envelopper, initialement pour saisir l'extrémité d'attaque de la feuille, pour tirer la feuille de ce distributeur et pour étendre un segment de feuille de bonne longueur et sous tension au point d'emballage, et pour réduire ensuite la tension de la feuille d'une valeur convenable dans les phases suivantes du cycle d'emballage ;

- des moyens d'exécution du préétirement transversal de la feuille, comprenant des brides de serrage (78-178) opposées reliées à des moyens de déplacement (79-179) rectiligne et auto-centrée et disposés pour saisir les bords longitudinaux de la partie de feuille étendue au point d'emballage, chacune des ces brides de serrage étant formée par une pluralité de brides de serrage adjacentes, tendant à se fermer sous l'action de moyens (89) élastiques correspondants et étant ouvertes par un système (92-93-96-99) de fonctionnement centralisé, des moyens étant prévus pour faire que les brides de serrage, non utilisées, saisissent la feuille à disposer à une hauteur inférieure à l'ensemble comprenant la plieuse arrière, la bride de serrage arrière et le mécanisme pousseur, des dispositions étant aussi prises pour réduire la tension longitudinale de la feuille, pendant la phase de préétirement, avec un avancement proportionnel de la bride de serrage (61) arrière qui maintient le rabat arrière de la feuille et avec une traction proportionnelle de la feuille du distributeur (30) de feuille ;

- un mécanisme de levage (3) situé au point d'emballage et apte à soulever le produit à envelopper contre la feuille qui est maintenue par lesdits moyens et qui s'appuie à l'avant sur la face arrière de la plieuse (37) avant fixe et à l'arrière sur un support (66) permettant à la feuille de glisser librement, et qui est disposé en face de la plieuse (52) arrière et parallèlement à celle-ci, et qui est monté, de préférence, sur la mâchoire de serrage supérieure de la bride de serrage (61) mobile de sorte qu'il peut quitter par la suite la plieuse arrière libre dans la phase finale d'insertion sur la plieuse avant ; les brides de serrage (78-178) latérales de préétirement pouvant s'approcher l'une de 50

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l'autre avec un parcours proportionné aux dimensions du produit alors que le produit est soulevé, tandis que la tension longitudinale de la feuille est convenablement réduite avec un avancement adapté de la bride de serrage (61) et une traction proportionnée de la feuille du distributeur (30) d'alimentation ; 5

- des moyens (78-178-52) de pliage mobiles pour exécuter le pliage sur le fond du produit initialement des rabats (F1) latéraux, formés par le préétirement transversal de la feuille et maintenus par les brides de serrage (78-178) latérales qui, dans ce but, sont mues pour effectuer un mouvement d'avancement l'une vers l'autre pour insertion sous le produit, les brides de serrage étant initialement fermées et avec une ouverture partielle à l'extrémité de leur parcours d'avancement qui est proportionné aux dimensions du produit, tandis que ces brides de serrage renversent les supports (14) mobiles du mécanisme de levage (3) qui retourne ensuite vers le bas à la position de début du cycle, la plieuse (52) arrière pouvant alors être mise en fonctionnement et étendant une partie du rabat (F2) arrière de la feuille sous le produit et sous une partie des rabats (F1) latéraux, pendant que la feuille reste fixée à la bride de serrage (61) arrière ; 15
- un mécanisme pousseur (55) qui est monté sur le chariot portant aussi la plieuse (52) arrière, immédiatement après cette plieuse, et qui agit sur le produit et le pousse sur la plieuse (37) avant tandis que le rabat (F3) avant de la feuille est tiré sous tension du distributeur (30) et est étendu sur le fond du produit, sur toute sa longueur, en étant disposé progressivement sous les autres rabats (F1-F2) de fond, tandis que la bride de serrage (61) arrière peut s'ouvrir au bon moment ; 25
- des moyens (40-41-42) de coupe, qui opèrent immédiatement en aval du distributeur (30) et qui coupent la feuille transversalement au bon moment pour séparer le rabat (F3) terminal avant de l'emballage de la nouvelle extrémité d'attaque de la feuille maintenue par le distributeur et qui au bon moment est saisie par la bride (61) arrière associée à la plieuse arrière et à l'ensemble formant mécanisme pousseur. 30

15. Machine selon la revendication 14, caractérisée en outre en ce qu'elle comprend : 50

- des moyens (1) pour amener au mécanisme de levage les produits à envelopper ;
- des moyens (5-6-7) pour mesurer les dimensions du produit placé sur le mécanisme de levage de temps en temps et pour déterminer, en fonction de ces dimensions, le fonctionnement des diverses pièces constitutives de la 55

machine, en particulier l'ensemble comprenant la plieuse (52) arrière, la bride de serrage (61) arrière et le mécanisme pousseur (55), et l'ensemble comprenant les brides de serrage (78-178) latérales pour le préétirement transversal, qui agissent aussi comme plieuses latérales ;

- un mécanisme presseur (76) agissant sur le produit dans la phase d'emballage, pour en empêcher des mouvements intempestifs lorsque la feuille d'emballage est progressivement relâchée par les brides de serrage (78-178) latérales et par la bride de serrage (61) arrière et est détachée du distributeur (30) ;
- des moyens (38) qui, lorsque le produit quitte le point d'emballage, exécutent le soudage des rabats de fond superposés de l'emballage. 16. Machine selon la revendication 14, dans laquelle le distributeur (30) de feuille est disposé au-dessous de la plieuse (37) avant, a son profil semblable à un peigne qui fait face à la plieuse (52) arrière, et est formé par une partie (230) inférieure fixe et une partie (130) supérieure qui peut être soulevée de la partie inférieure en opposition à des moyens élastiques, au moins deux rouleaux (29) parallèles et superposés étant prévus en amont des deux parties et étant associés à chacune des parties du distributeur de sorte que le bord d'attaque de la feuille dévidée d'une nouvelle bobine peut être facilement inséré entre ces parties, au moins l'un de ces rouleaux étant relié à des moyens de frottement tels que la feuille peut être tirée du distributeur uniquement lorsqu'une force de traction longitudinale spécifiée est dépassée. 17. Machine selon la revendication 14, dans laquelle les moyens de coupe fonctionnant en aval du distributeur (30) comprennent une contre-lame (40) à gorge fixée entre les rouleaux de la plieuse (37) avant, parallèlement à ceux-ci, et au-dessous et à l'opposé d'elle une lame (42) dentelée ou d'autres moyens adéquats de coupe ou d'affaiblissement transversal de la feuille, reliés à des moyens de guidage et de soulèvement et d'abaissement, par exemple une structure en forme de parallélogramme (43) articulé mue par un électro-aimant (45) et par un moyen (46) de retour élastique. 18. Machine selon la revendication 14, dans laquelle la plieuse (37) avant est formée par une pluralité de rouleaux fous qui sont parallèles l'un à l'autre et transversaux par rapport au sens d'avancement du produit lorsqu'il quitte la machine, ces rouleaux étant montés sur la structure qui porte aussi le convoyeur (38) de soudage suivant auquel ces rouleaux sont reliés mécaniquement, le mouvement des rouleaux étant donné par un seul moteur (39).

19. Machine selon la revendication 18, dans laquelle la structure portant les rouleaux d'entrée de la plieuse (37) avant et le convoyeur (38) de soudage est reliée à la structure formant le bâti de la machine de telle manière qu'elle peut être soulevée pour permettre l'accès au distributeur (30) et aux moyens de frottement associés, pour l'insertion entre ceux-ci du bord d'attaque de la feuille dévidée d'une nouvelle bobine.

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20. Machine selon la revendication 14, dans laquelle se trouvent articulés, sur les côtés de la partie inférieure fixe du distributeur (30), des leviers (34) s'étendant en avant, tendant à se déplacer vers le haut sous l'action de moyens (36) élastiques et portant chacun de façon rotative à son extrémité un rouleau (33) parallèlement au distributeur, disposé sous la feuille quittant le distributeur et normalement disposé en face de la plieuse avant pour garder la feuille étendue au point d'emballage et maintenue par son autre extrémité par la bride de serrage arrière associée à la plieuse arrière, dans une position sensiblement horizontale et à une hauteur telle qu'elle peut être saisie par les éléments actifs des brides de serrage (78-178) latérales pour le préétirement et le pliage, ces leviers pouvant coopérer avec des blocs (53) fixés au chariot (48) de l'ensemble formant plieuse arrière, lorsque ce chariot atteint l'extrémité du parcours de manœuvre, de sorte que le rouleau est disposé sous la bride de serrage arrière qui prend la feuille du distributeur, et en conséquence sous le segment suivant de feuille qui sera tiré de ce distributeur.

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21. Machine selon la revendication 14, dans laquelle la plieuse (52) arrière a une forme plate, possède des surfaces lisses et des bords parfaitement arrondis, et est telle qu'à la fin du cycle opératoire, lorsqu'elle est relâchée par la bride de serrage (61) arrière sous-jacente qui maintient le rabat arrière de la feuille, elle est partiellement introduite dans la plieuse (37) avant et est tirée à l'extérieur et / ou relâchée par le rabat (F2) arrière de la feuille d'emballage qu'elle a étendue sur le fond du produit, lorsque ce bord a été partiellement superposé sur le rabat (F3) avant terminal.

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22. Machine selon la revendication 14, dans laquelle se trouvent fixés, sur le fond de la partie intermédiaire du chariot (48) portant la plieuse arrière et le mécanisme pousseur, deux supports (56) s'étendant vers l'arrière et supportant de façon rotative l'extrémité d'un arbre (57) parallèlement au chariot, supports sur lesquels se trouve montée de façon rotative la partie intermédiaire d'une fourche (60) dont les dents de fourche sont dirigées en avant et portent la mâchoire de serrage (161) supérieure de la bride de serrage (61) arrière pour prendre la feuille du distributeur (30), la partie arrière de la

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fourche étant disposée pour coopérer avec un excentrique (65) calé à l'extrémité d'un arbre (62) qui est monté tournant par les supports, parallèlement au chariot (48) mentionné précédemment, et dont l'autre extrémité atteint un côté du chariot où elle est montée tournante et où elle porte en y étant fixée, un levier (63) dirigé vers le haut et relié à un moyen (64) élastique par l'action duquel l'excentrique tend normalement à être disposé dans la position d'excentricité maximale et à maintenir la mâchoire de serrage supérieure de la bride de serrage soulevée et en appui sur la surface inférieure de la plieuse (52) arrière, des dispositions étant prises de sorte que lorsque le chariot décrit ci-dessus atteint l'extrémité de son parcours d'avancement vers la plieuse avant, le levier coopère avec une came (75) fixe provoquant la rotation de l'excentrique dans la position de moindre excentricité (165) dont il résulte que la mâchoire de serrage supérieure de la bride de serrage est abaissée et est préparée à une coopération avec le distributeur (30) de feuille ; un levier (58), disposé à l'intérieur de la fourche (60), étant fixé sur l'extrémité de l'arbre qui forme le pivot de la mâchoire de serrage supérieure, supportant la mâchoire de serrage (261) inférieure de la bride de serrage en question et tendant à remonter sous l'action d'un ressort (69) à lames fixé à la fourche (60), l'arbre (57) qui forme le pivot de la bride de serrage étant fait pour s'étendre d'un côté du chariot supportant la bride de serrage, où cet arbre est monté tournant et porte, fixé à lui, un levier (58) dirigé vers le haut qui, lorsque ce chariot atteint l'extrémité du parcours d'avancement vers la plieuse avant, coopère avec une came (71) qui provoque initialement l'abaissement partiel de la mâchoire de serrage inférieure lorsque la mâchoire de serrage supérieure est encore soulevée, avec préouverture consécutive de la bride de serrage qui dégage le rabat arrière de la feuille, après quoi, lorsque la mâchoire de serrage supérieure a été abaissée, la came provoque l'abaissement de la mâchoire de serrage inférieure, abaissement nécessaire pour permettre à la bride de serrage d'entrer, à l'état ouvert, dans le distributeur, après quoi la came cesse d'agir et la mâchoire de serrage inférieure est fermée élastiquement sur la mâchoire de serrage supérieure, en serrant la feuille disposée dans le distributeur, des dispositions étant prises de sorte que dans la phase suivante de retrait du chariot, lorsque le levier actionnant l'excentrique (65) dégage la came (75) correspondante et que l'excentrique est disposé dans la position de plus grande excentricité, la bride fermée est soulevée et est amenée en appui sur la surface inférieure de la plieuse arrière.

23. Machine selon la revendication 22, dans laquelle la came (71) provoquant l'ouverture et la fermeture de la bride de serrage (61) arrière pour prendre la

feuille du distributeur, est montée sur un support (72) pouvant osciller sur un axe (73) parallèlement à l'axe longitudinal de la machine, en opposition à un moyen (74) élastique de sorte que, lorsque le levier est dégagé par la came, cette dernière présente derrière le levier une face inclinée transversalement, de sorte que dans le parcours de retour consécutif de la bride de serrage (61) arrière, le levier passe latéralement à travers la came qui est neutralisée en basculant latéralement en opposition au moyen élastique et qui ensuite, lorsqu'elle est dégagée du levier, retourne à la position active pour le cycle suivant.

24. Machine selon la revendication 22, dans laquelle l'arbre (57) qui forme le pivot pour la bride de serrage (61) pour prendre la feuille du distributeur est soumis à l'action d'un ressort (70) miniature qui compense partiellement le poids de la bride de serrage pour simplifier le fonctionnement de l'excentrique (65) qui modifie la position de la bride de serrage par rapport à la hauteur.

25. Machine selon la revendication 14, dans laquelle les brides de serrage (78-178) latérales sont fixées aux chariots (80) de support correspondants reliés à l'appareillage (79-179) de mouvement auto-centréur comportant une structure sensiblement de type en parallélogramme articulé, de sorte que la mâchoire de serrage (86) supérieure reste toujours disposée horizontalement, des moyens (89) élastiques étant prévus pour que les mâchoires de serrage de chaque bride de serrage puissent tendre à remonter, dans la position fermée où le soulèvement de la bride de serrage est entravé par l'appui de la mâchoire de serrage (84) inférieure sur la mâchoire de serrage (86) supérieure.

26. Machine selon la revendication 25, dans laquelle chaque bride de serrage (78-178) latérale comprend une came (83) fixée, en en faisant saillie, au côté intérieur du chariot (80) supportant chaque ensemble de brides de serrages ; une mâchoire de serrage (84) inférieure articulée par une extrémité fourchue à la came, une mâchoire de serrage (86) supérieure pourvue de talons latéraux faisant saillie vers le bas, qui sont articulés (87) à la partie intermédiaire de la mâchoire de serrage inférieure et qui portent sous cette articulation un rouleau (88) à gorge fou qui coopère avec le profil de la came, des ressorts (89) étant fixés sur des extrémités opposées de l'axe (188) de ce rouleau, et reliés à leurs autres extrémités au chariot pour maintenir la coopération entre le rouleau et la came, le tout étant fait d'une manière telle qu'en donnant à la came un profil particulier, il est possible de contenir la pression que les brides de serrage, lorsqu'elles sont poussées vers le bas et ouvertes par la coopération avec la plieuse (52) arrière, exercent sur cette

5 10 15 20 25 30 35 40 45 50 55

plieuse.

27. Machine selon la revendication 26, dans laquelle le chariot (48) de l'ensemble formant plieuse arrière porte sous lui des blocs (53-54) transversaux en forme de coin qui, pendant le mouvement du chariot, coopèrent avec les mâchoires de serrage supérieures des brides de serrage (78-178) latérales pour abaisser ces brides de serrage et pour les empêcher de gêner la bride de serrage (61) arrière montée sur le même chariot.

28. Machine selon la revendication 26, caractérisée en ce que l'articulation (85) des mâchoires de serrage (84) inférieures de chaque jeu de brides de serrage (78-178) latérales est formé par un arbre monté tournant par les cames (83) des brides de serrage, l'arbre étant libre par rapport aux mâchoires de serrage inférieures et possédant, fixés transversalement à lui, des doigts (94) disposés sur le côté de chaque bride de serrage et au-dessus de chevilles (95) correspondantes fixées, en en faisant saillie, à l'une des dents de fourche de l'extrémité fourchue de chaque bride de serrage, l'arbre ayant un levier (92) d'une pièce qui est ajusté sur une extrémité à angle droit et possède à une extrémité un rouleau (93) à gorge qui passe sous une barre (96) horizontale rectiligne reliée à des moyens de soulèvement et d'abaissement, qui comprennent, par exemple, une structure (97) en parallélogramme articulé, un servomécanisme d'entraînement du type à vis et à taraudage (98-198), et un moteur électrique commandé par l'ordinateur (7) de la machine, de sorte qu'avec ces moyens, il est possible d'ouvrir et de fermer les brides de serrage avec un cycle adaptable en fonction des dimensions du produit à envelopper.

29. Machine selon la revendication 14, caractérisée en ce que le mécanisme de levage (3) qui introduit le produit dans le point d'emballage est pourvu de supports (14) oscillants maintenus dans la position élevée par des moyens (15) élastiques et qui sont renversés par coopération avec la mâchoire de serrage inférieure des brides de serrage (78-178) latérales, les premiers rangs de ces supports, plus proches de la plieuse (52) arrière, étant montés sur des pattes d'attache (8) pouvant basculer sur la poutre (9) tubulaire qui les supporte, qui vont au-delà de cette poutre et chacune d'elle portant, articulé au prolongement (108), un cliquet (17) ayant son extrémité en face de cette poutre orientée vers le haut et est contraint par des moyens (18) élastiques de coopérer avec une came (20) fixée sur la poutre (19) et qui maintient la patte d'attache dans la position horizontale normale ; des moyens (25-125-26) étant prévus qui, en fonction de la position de début de cycle de la plieuse arrière, changent la position d'une tige (21) guidée horizontale pouvant,

pendant le soulèvement du mécanisme de levage, coopérer avec les cliquets (17) pour provoquer le basculement vers le bas des pattes d'attache (8) qui, avec les supports oscillants correspondants, ne doivent pas gêner la plieuse, toute patte d'attache (8) neutralisée pouvant coopérer, dans le parcours consécutif vers le bas du mécanisme de levage, avec des butées (22) fixes qui la renvoient à la position horizontale, le cliquet (17) revenant en coopération par un mouvement d'enclenchement avec la came (20) correspondante.

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30. Machine selon la revendication 14, caractérisée en ce qu'elle comprend, latéralement et au-dessous ou au-dessus du trajet d'alimentation du produit au mécanisme de levage (3), des rangées de capteurs (5-6) optoélectroniques qui mesurent de temps à temps la longueur, la largeur et la hauteur du produit à envelopper, et qui envoient ces données à un ordinateur (7), auquel elles sont fournies par des instructions (207) manuelles quelconques, et toutes données relatives aux caractéristiques des produits à envelopper et relatives aux caractéristiques de la feuille utilisée, le tout d'une manière telle qu'en traitant ces variables, l'ordinateur peut commander le retrait et l'avance de l'ensemble comprenant la plieuse arrière, la bride de serrage arrière et le mécanisme pousseur (52-61-55), ainsi que le rapprochement et le retrait l'une de l'autre des brides de serrage (78-178) latérales pour le préétirement transversal et le pliage des rabats latéraux de la feuille, les parcours étant de temps en temps proportionnés aux dimensions et à toutes caractéristiques du produit à envelopper.

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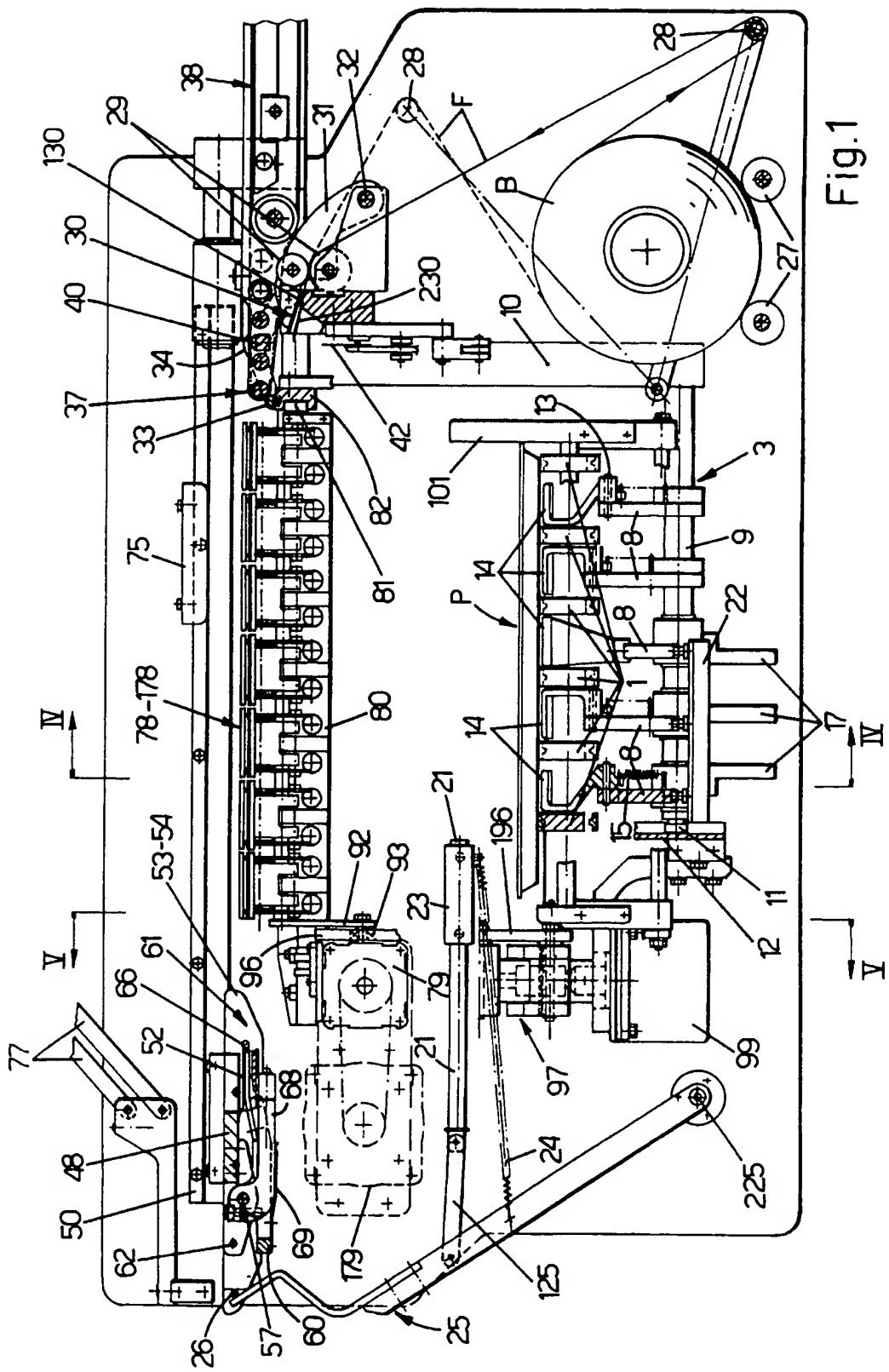
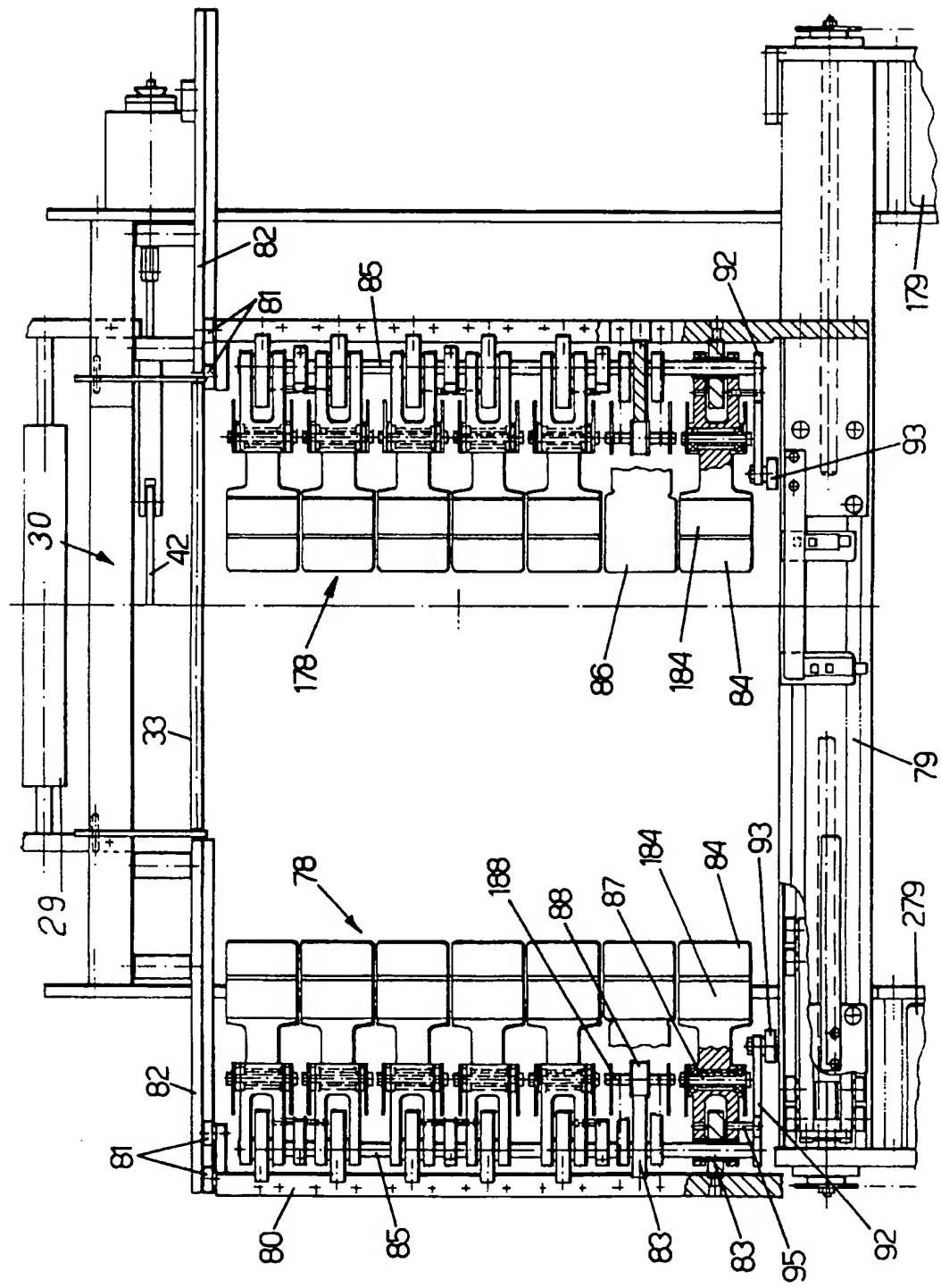
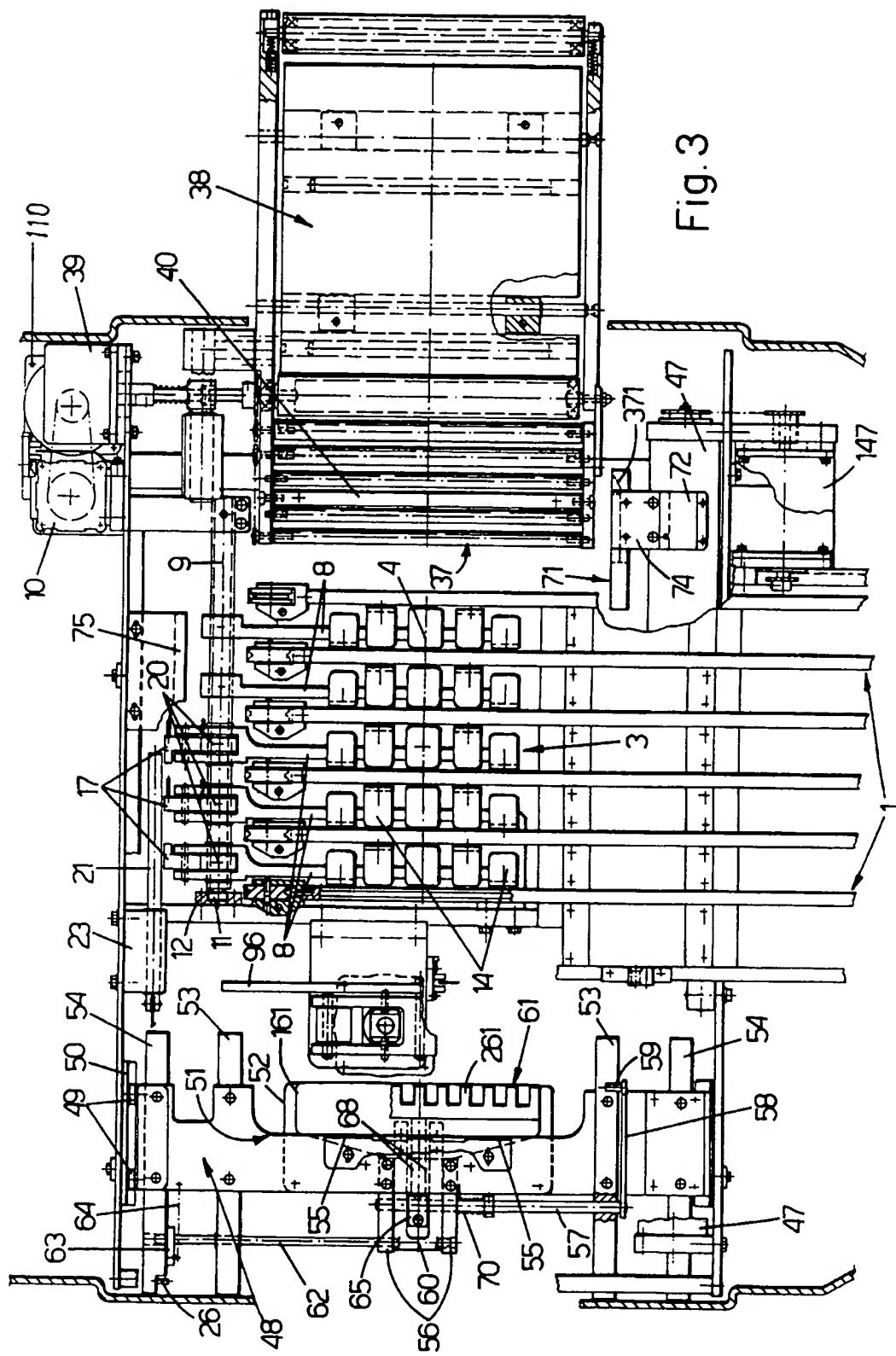


Fig. 1.

Fig. 2





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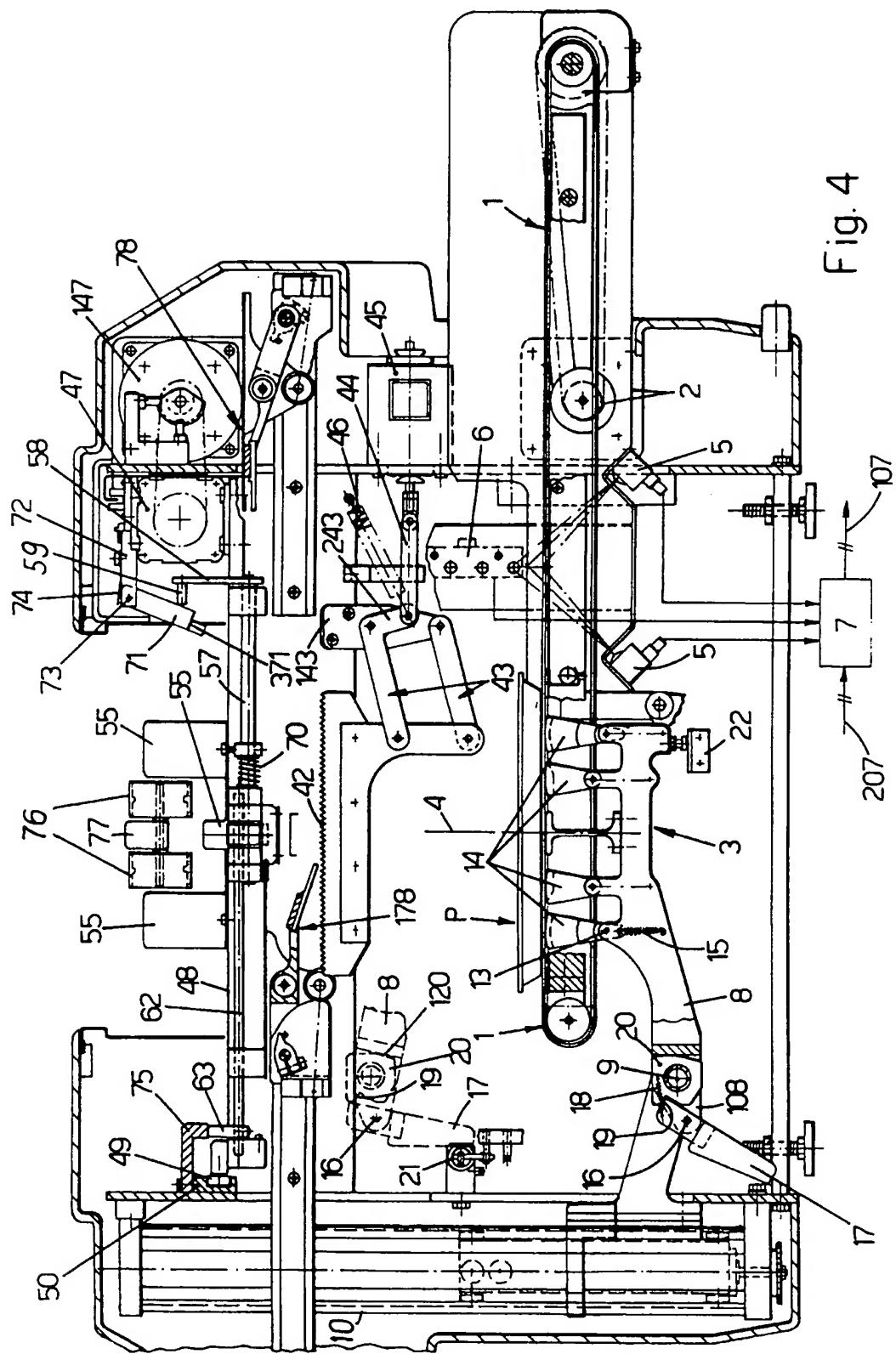


Fig. 4

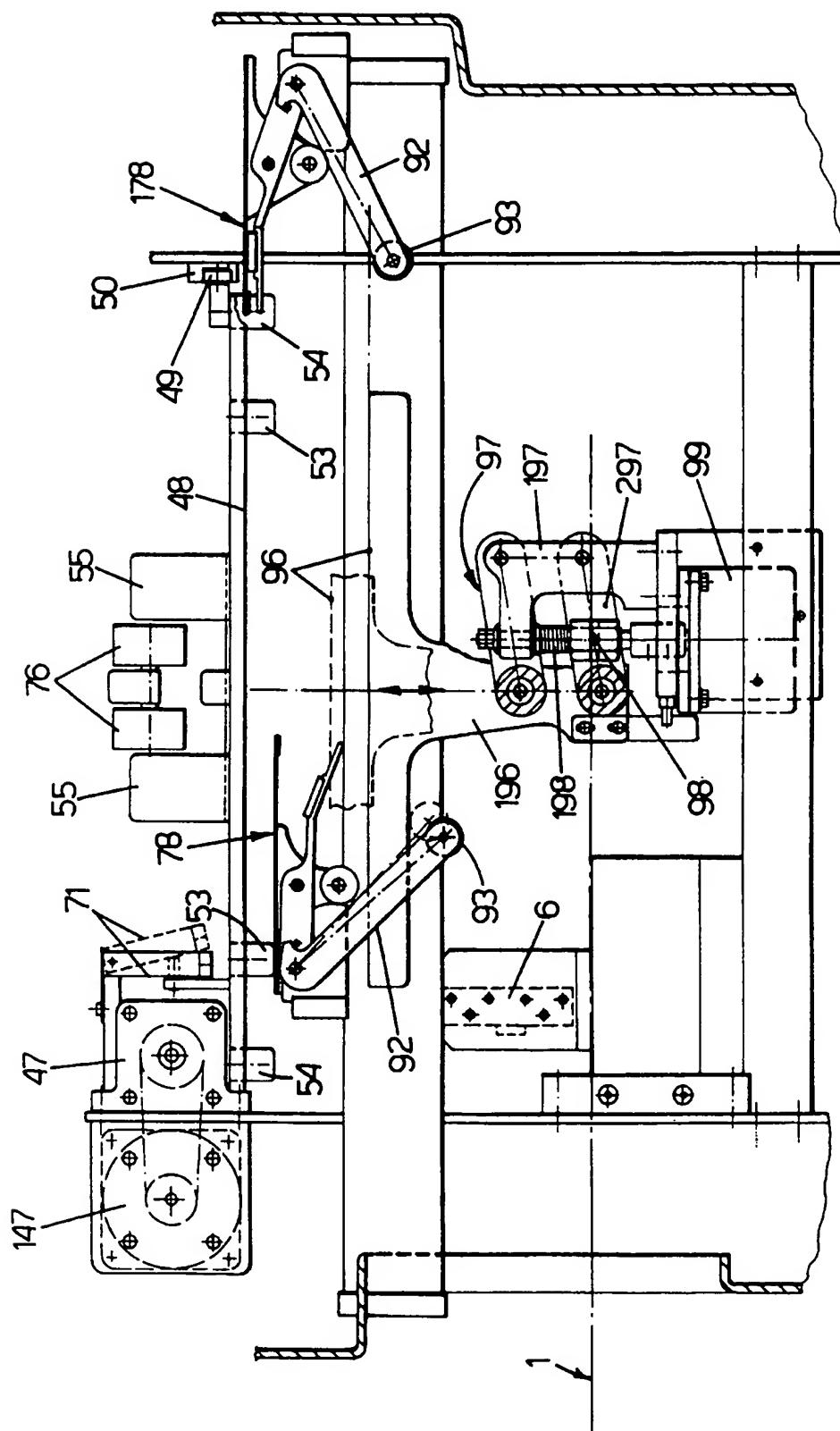


Fig. 5

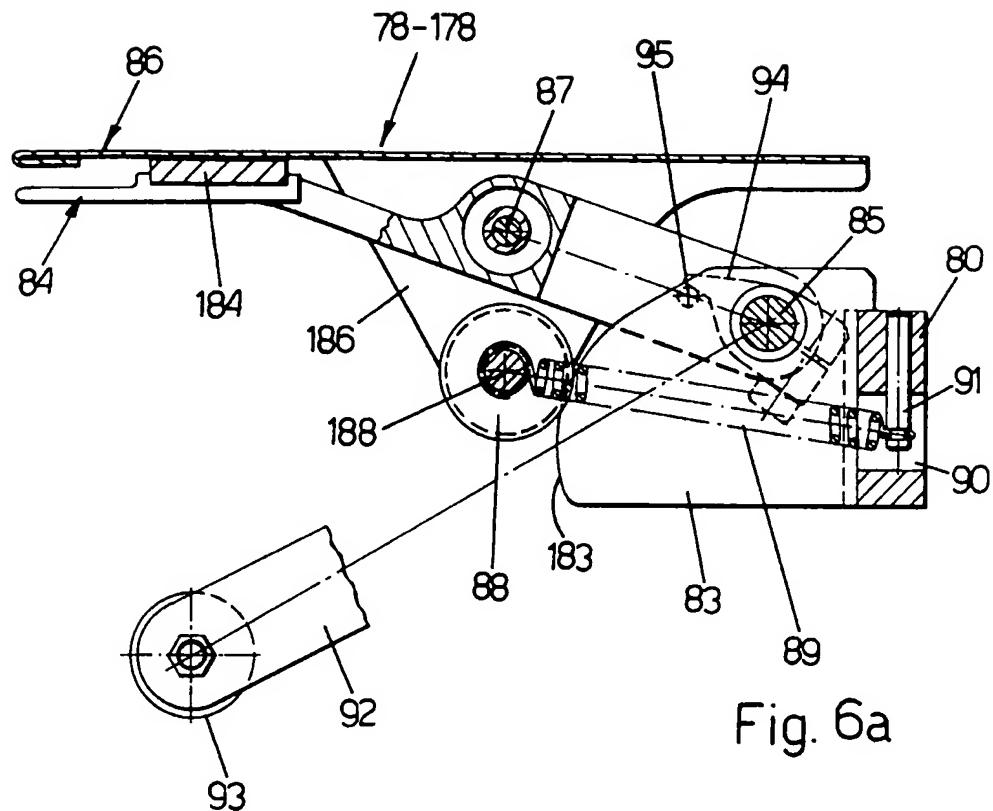


Fig. 6a

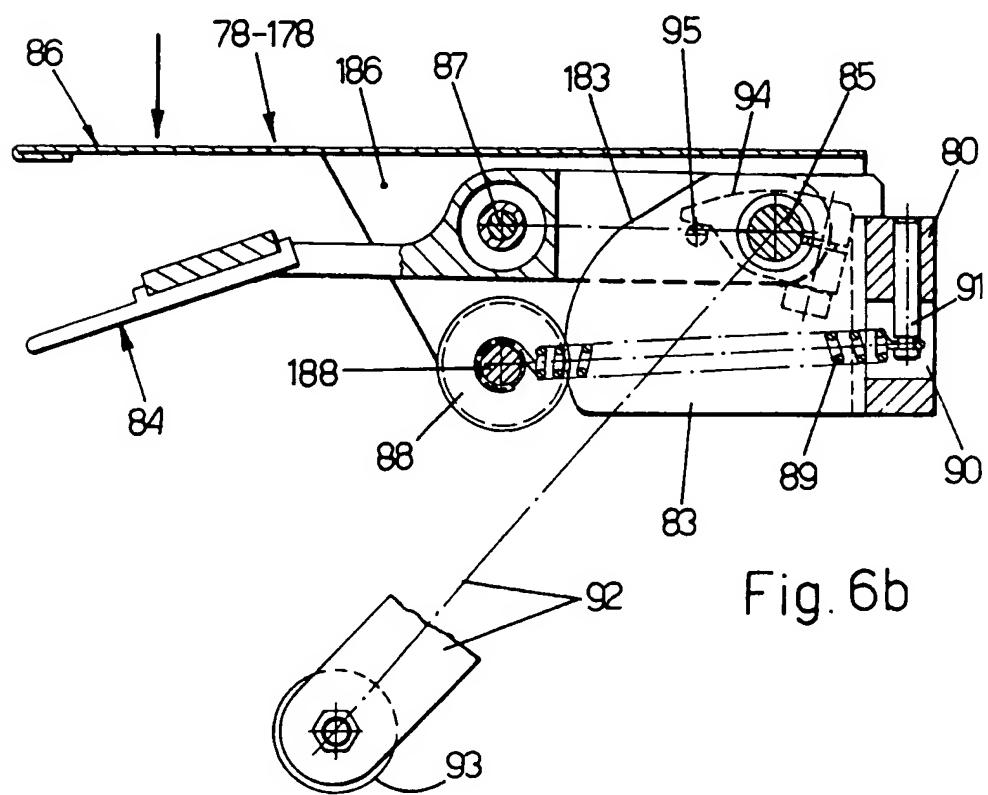


Fig. 6b

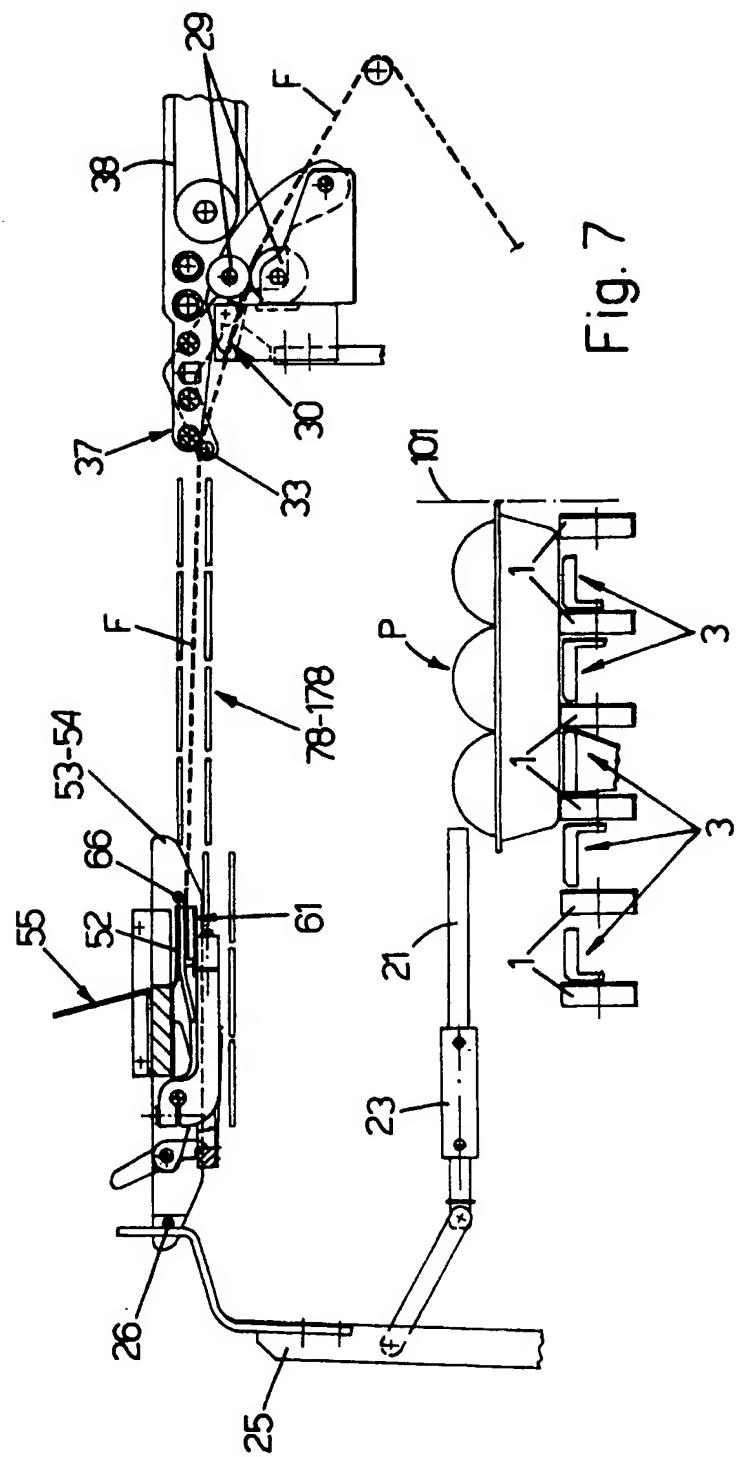
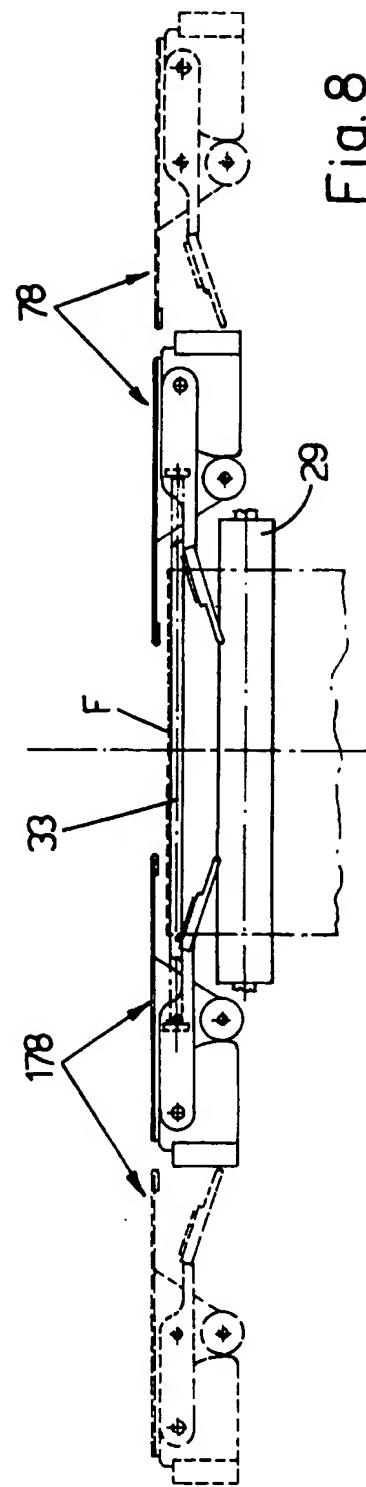


Fig. 8



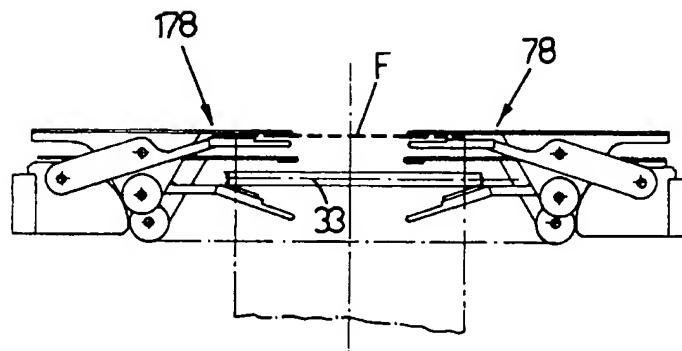


Fig. 9

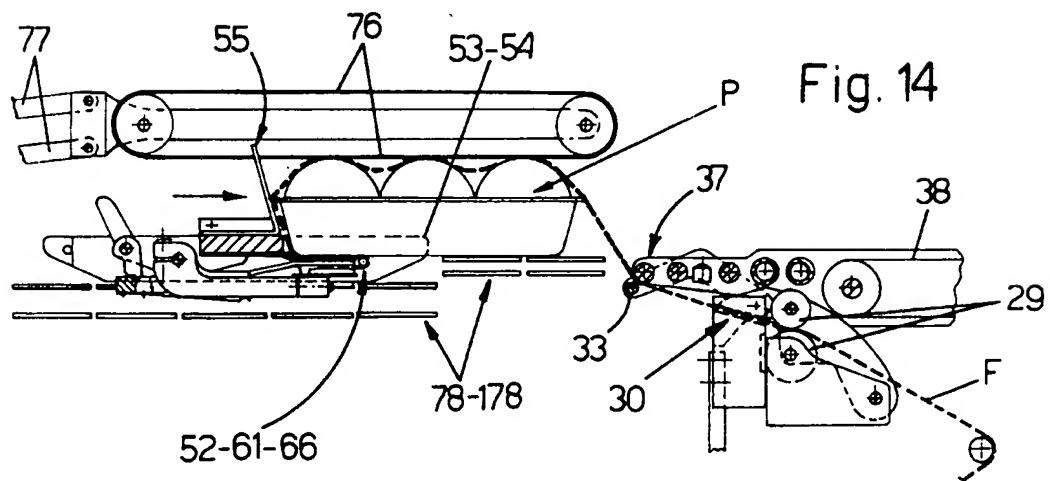


Fig. 14

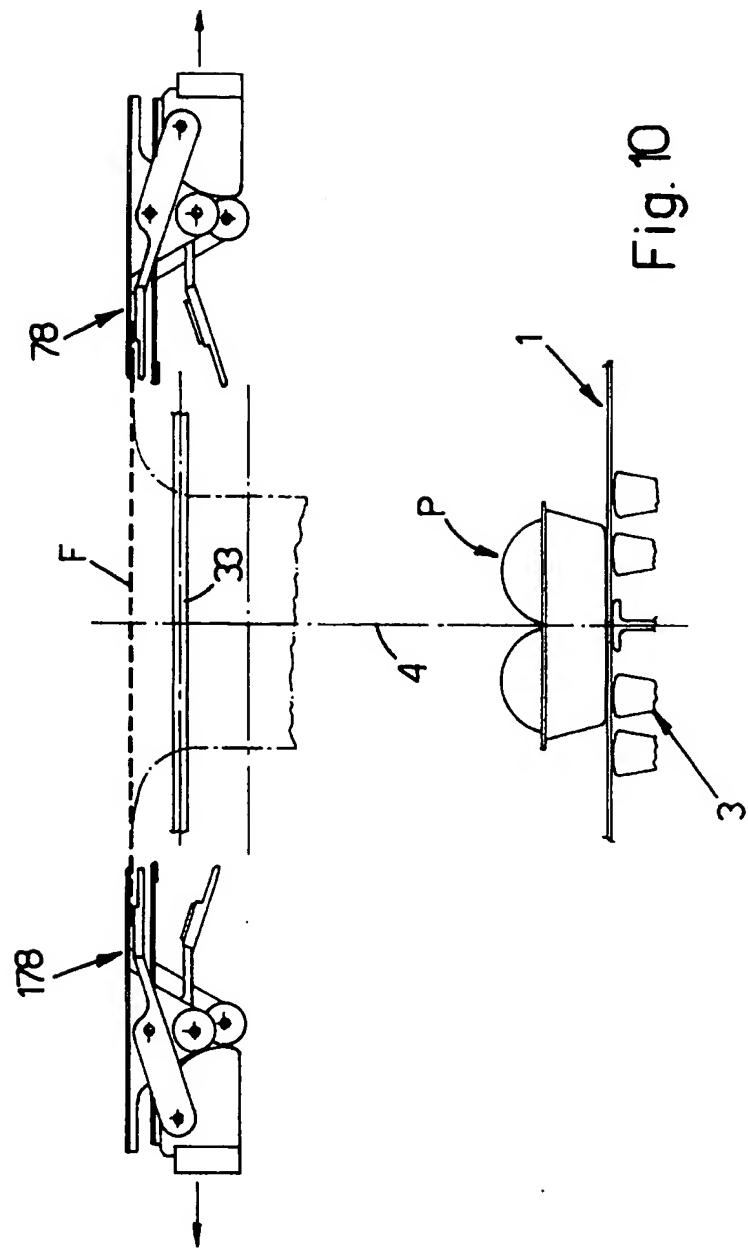


Fig. 10

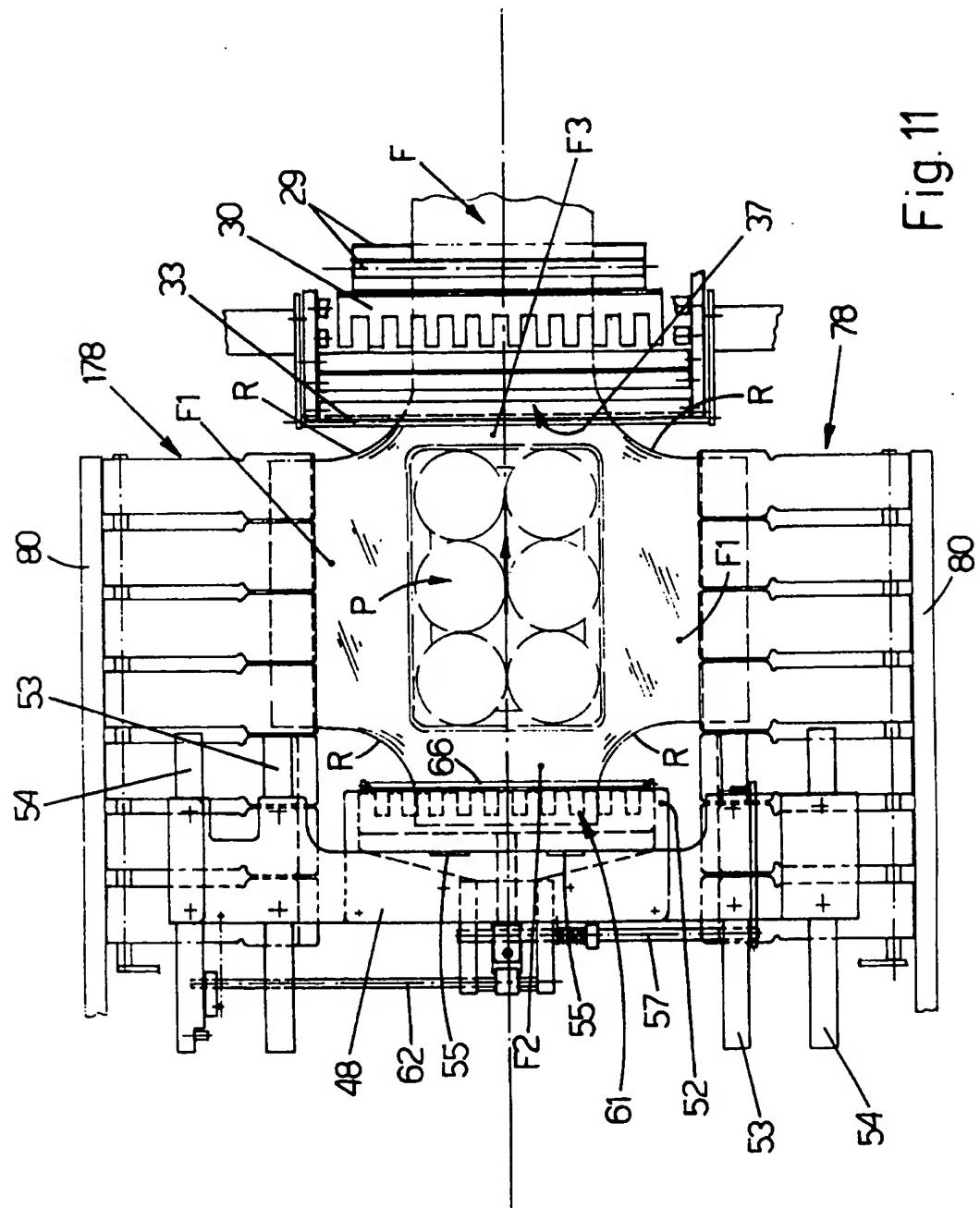
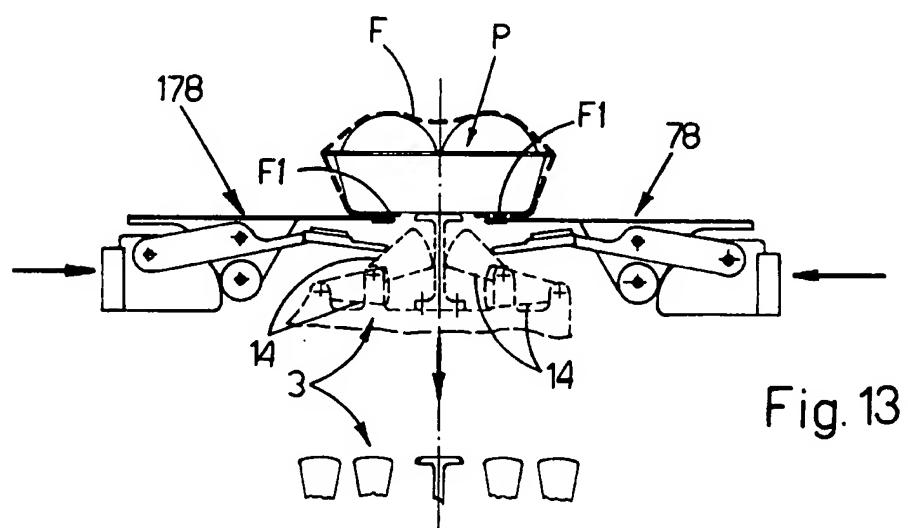
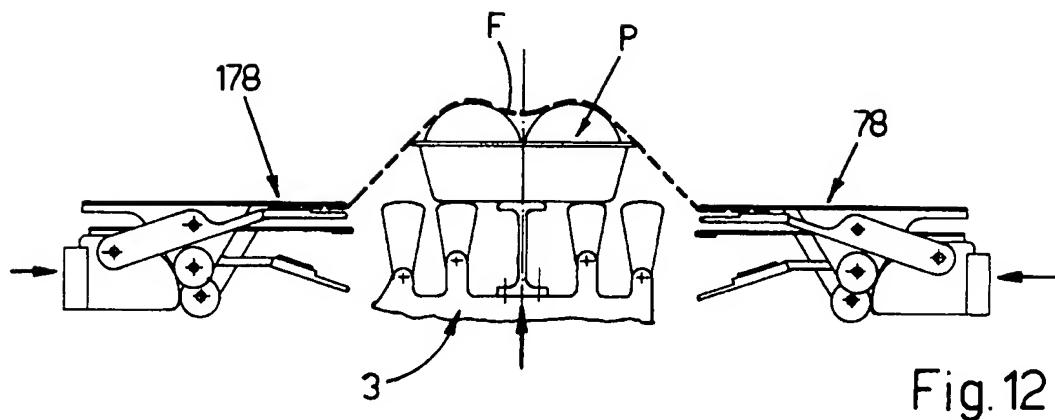
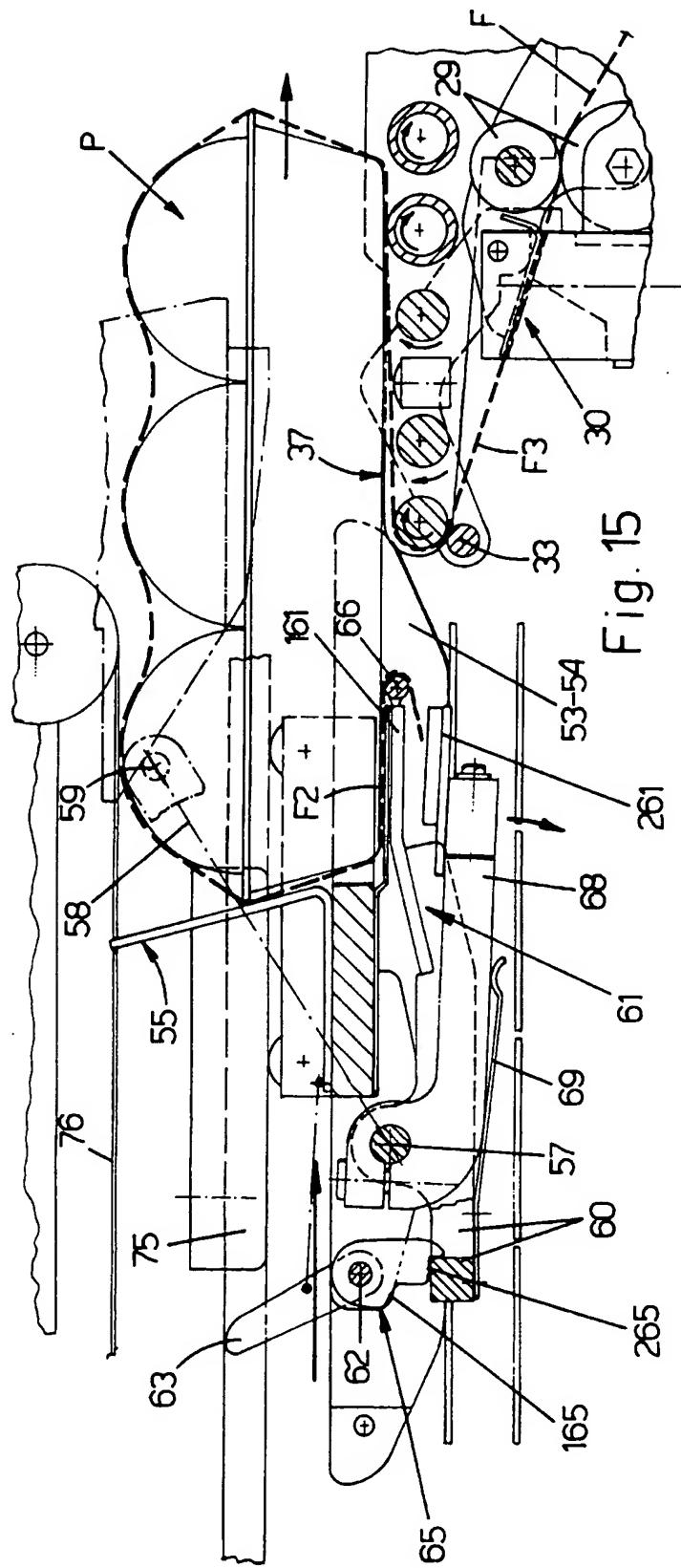


Fig. 11





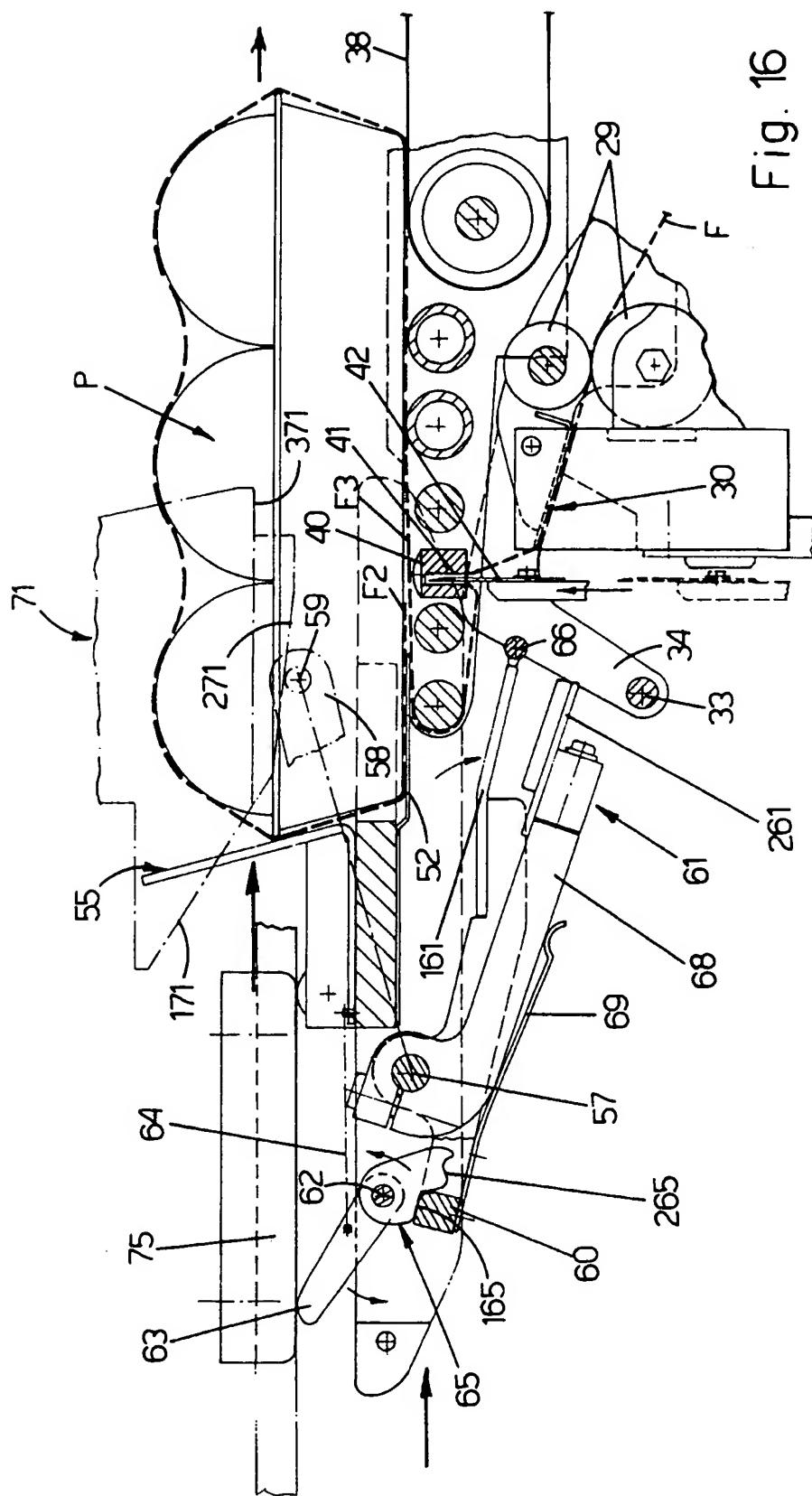


Fig. 16.

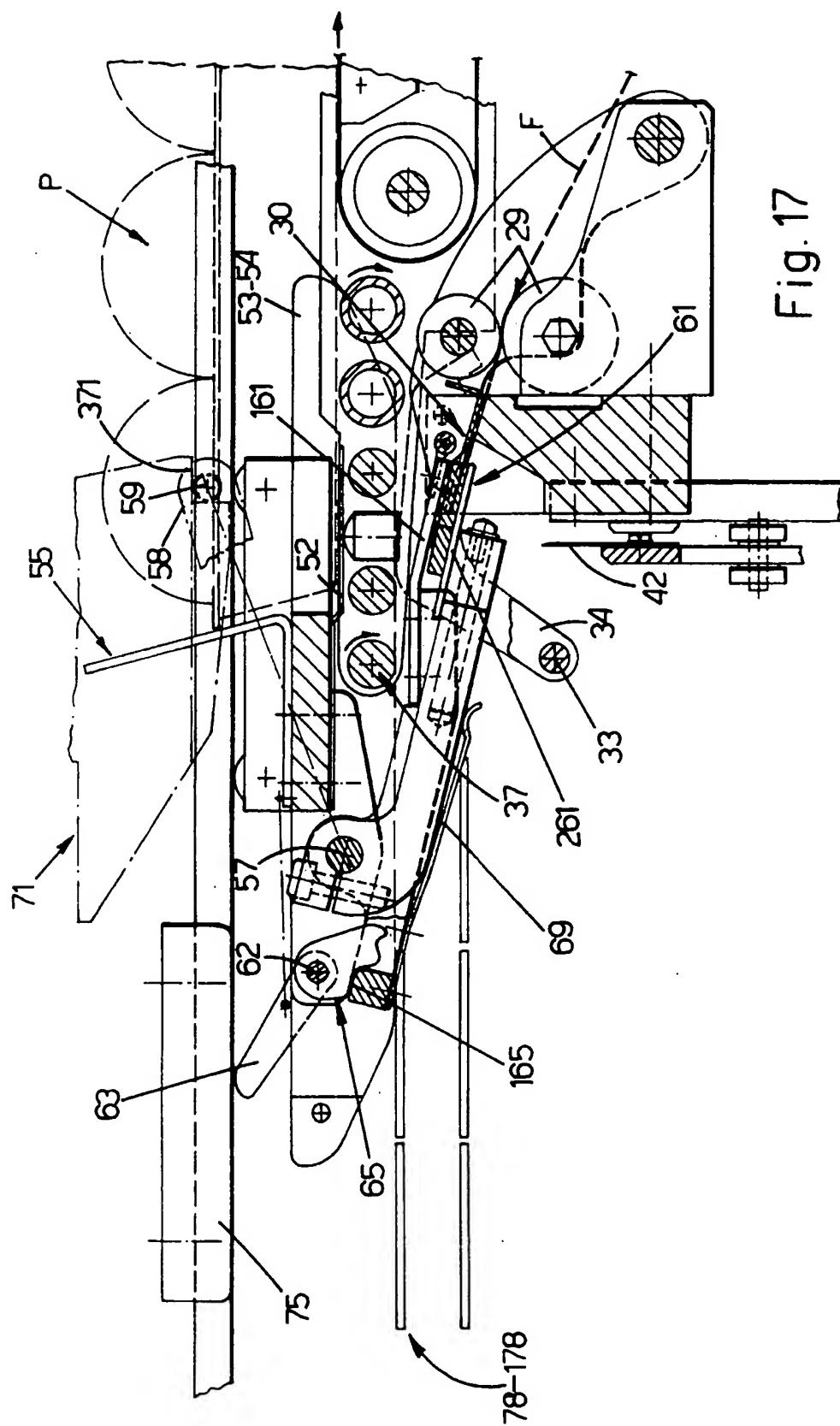


Fig. 17

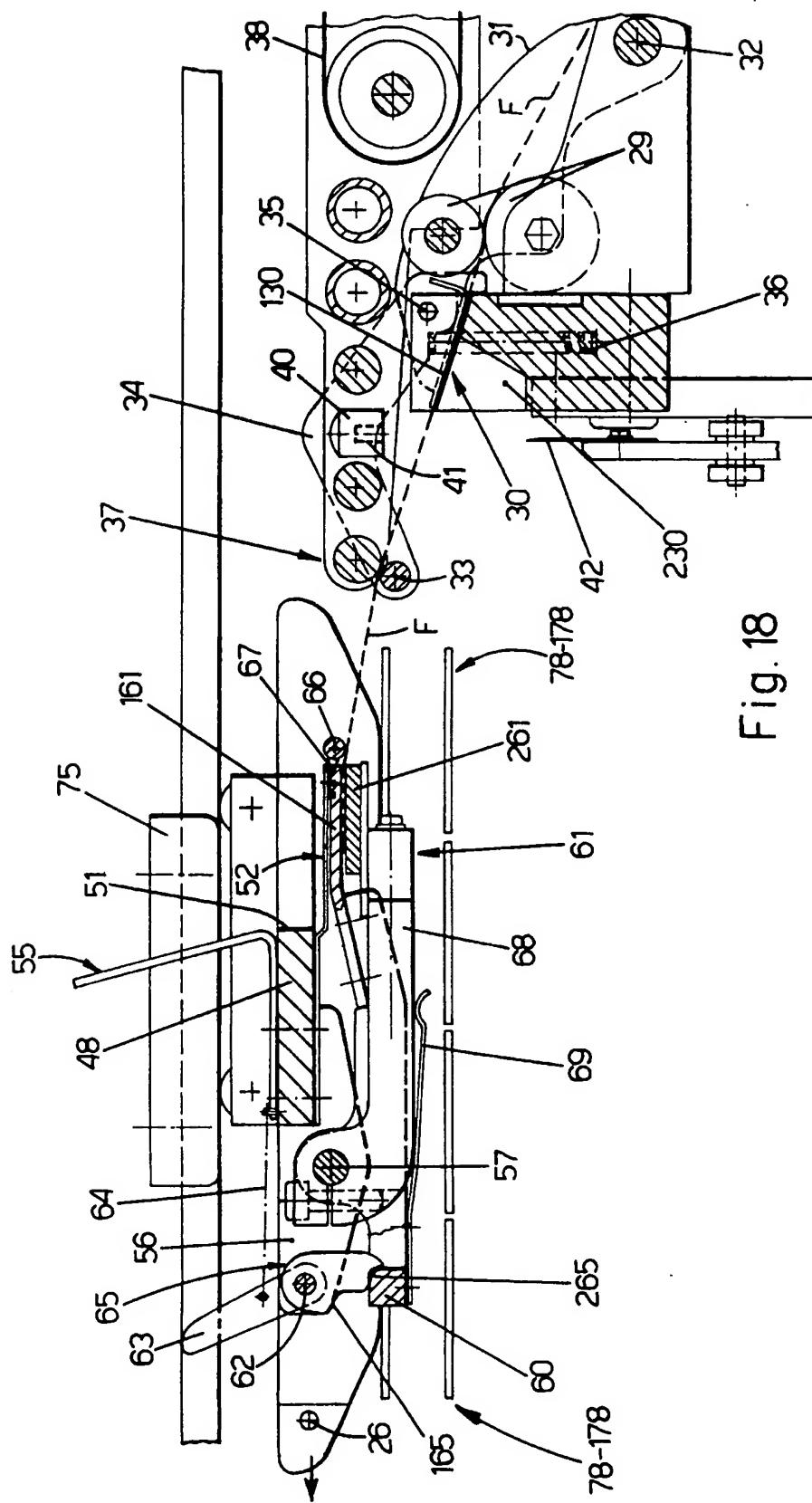


Fig. 18

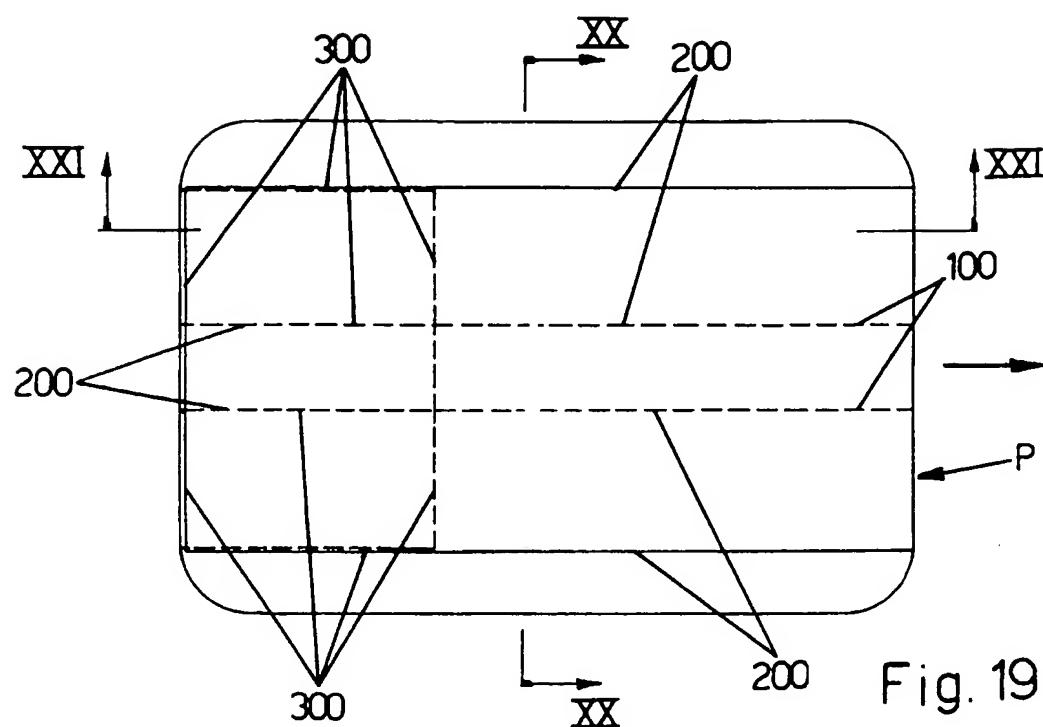


Fig. 19

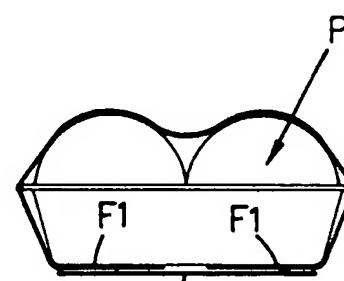


Fig. 20

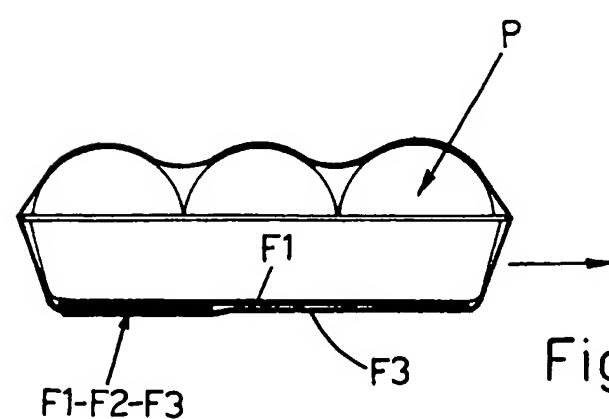


Fig. 21